# CHEMICAL
## & Metallurgical
# ENGINEERING



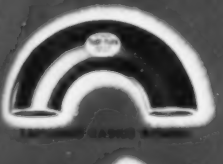


# TUBE-TURN

TRADE MARK

## WELDING FITTINGS AND FLANGES

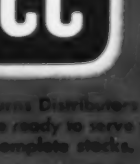
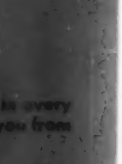








### TUBE-TURN WELDING FITTINGS—RANGE OF SIZES

| Type of Fitting | Description | Standard Weight | Extra Strong | Schedule 160 | Double Extra Strong | Light Gauge Nominal Pipe Size | Light Gauge Iron Pipe Size |
|---|---|---|---|---|---|---|---|
| Elbows | 90° Long Radius | ½"-24" | ½"-24" | 1" 12" | ¼"-8" | 4"-24" | 3"-12" |
| Elbows | 90° Short Radius | 1"-30" | 1½"-30" | | | | |
| Elbows | 45° Long Radius | ½"-30"* | ½"-30"* | 1"-12" | ¼"-8" | 4"-24" | 3"-12" |
| Returns | 180° Long Radius | ½"-24" | ½"-24" | 1"-12" | 3"-8" | 4"-24" | 3"-12" |
| Returns | 180° Short Radius | 1"-30" | 1½"-30" | | | | |
| Returns | 180° Extra Long Radius | 1"-2½" | 1"-2½" | | | | |
| Tees | Straight | ½"-24" | ½"-24" | ½"-12" | ½"-8" | | |
| Tees | Reducing Outlet | ½"-24" | ½"-24" | ½"-12" | ½"-8" | | |
| Reducers | Concentric & Eccentric | 1x½-24x20 | 1x½-24x20 | | 1x½-8"x6" | | |
| Caps | | 1"-24" | 1"-24" | | 1"-8" | | |
| Stub Ends | Lap Joint | 1"-24" | 1"-24" | | | | |
| Nipples | Shaped, 90° to Header | 1¼"-12" | 1¼"-12" | | | | |
| Nipples | Shaped, 45° to Header | 1¼"-12" | 1¼"-12" | | | | |
| Saddles | | 2"-24"** | | | | | |
| Laterals | Straight | 1¼"-24" | 1¼"-24" | | | | |
| Laterals | Reducing-on-Run | 1¼"-24" | 1¼"-24" | | | | |
| Crosses | Straight | ⅛"-24" | ⅛"-24" | | | | |
| Rings | Welding | ⅛"-12" | ⅛"-12" | | | | |
| Sleeves | Welding | 2"-24"** | | | | | |

SUPER Tube-Turn 45° long radius elbows, 90° long radius elbows, and 180° long radius returns available in both Standard weight and Extra Strong in sizes from 3" to 12".

Tube-Turn welding fittings and flanges conform to applicable ASA and ASTM Standards. For further details please refer to Tube Turns catalog and data book No. 111.

*30° size short radius

**Since saddles and sleeves are used for external reinforcement only, they do not conform to iron pipe size thicknesses.

### TUBE-TURN FORGED STEEL FLANGES—RANGE OF SIZES

| | 150 Lb. | 300 Lb. | 400 Lb. | 600 Lb. | 900 Lb. | 1500 Lb. | 2500 Lb. |
|---|---|---|---|---|---|---|---|
| Welding Neck | ½"-24" | ½"-24" | ½"-24"† | ½"-24" | ½"-24"* | ½"-24" | ½"-24" |
| Slip-on | ½"-24" | ½"-24" | ½"-24"† | ½"-24" | ½"-24"* | ½"-24" | ½"-24" |
| Lap Joint | ½"-24" | ½"-24" | ½"-24"† | ½"-24" | ½"-24"* | ½"-24" | ½"-24" |
| Threaded | ½"-24" | ½"-24" | ½"-24"† | ½"-24" | ½"-24"* | ½"-24" | ½"-24" |
| Blind | ½"-24" | ½"-24" | ½"-24"† | ½"-24" | ½"-24"* | ½"-24" | ½"-24" |
| Socket Type | ¼"-24" | ¼"- 4" | | ¼"-3½" | | | |
| Reducing-threaded or slip-on | ¼"-24" | ¼"-24" | ¼"-24"† | ¼"-24" | ¼"-24"* | ¼"-24" | ¼"-12" |
| Orifice—threaded | | 1"-24" | 4"-12" | 4"-12" | 3"-12" | 1"-12" | |
| Orifice—slip-on | | 1"-24" | | | | | |
| Orifice—welding neck | | 1"-24" | 4"-12" | 1"-12" | 3"-12" | 1"-12" | |
| Long Welding Neck | 1"-24" | 1"-24" | 1"-24" | 1"-24" | 1"-24" | 1"-24" | 1"-12" |

†Dimensions on sizes thru 3½" same as for 600 lb. flanges.
*Dimensions on sizes thru 2½" same as for 1500 lb. flanges.

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# In this Issue





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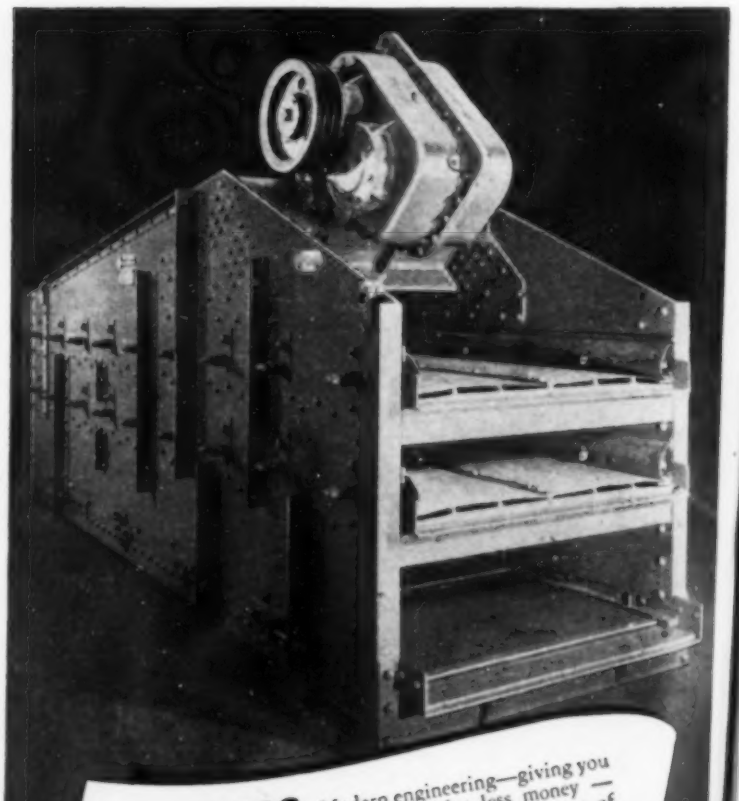

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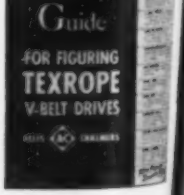


Texrope Drives — prices, sizes of belts, sheaves, etc. Bulletin B6051F.

CHEMICAL
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ESTABLISHED 1902 JUNE 1946 SIDNEY D. KIRKPATRICK, Editor

# BIKINI BOUND

THIS is being written in California as we are about to board a ship for what has been called "the greatest single experiment in all history." Certainly from all we have seen and heard of the scientific and technical preparations, there never has been a research project so carefully planned and with such exhaustive arrangements for measuring, studying and recording its results. Yet this is truly an "excursion into the unknown" for many of us. We have been warned that we might expect a few discomforts—"crowded living conditions...undoubtedly aggravated by the prevailing tropical climate...in no sense a cruise or pleasure jaunt." But there is widespread conviction among us—at least at the start—that the witnessing of this impressive experiment will more than compensate for any inconveniences that may be experienced during more than two months aboard ship.

Some there are among us, judging from the published statements of the Federation of American Scientists, who "are cooperating in these tests at the request of their country's armed forces, although they do so with heavy hearts and without enthusiasm." They seem to feel that participation in the tests is itself an admission of their own defeat in their efforts to teach men that atomic warfare means an end of civilization. We admire their idealism but at this stage of the game most of us are in favor of "keeping our powder dry." A new and revolutionary weapon has been developed and it behooves us to learn as much as we can about its effects upon all our means of defense. If we don't, we take the chance of some future disaster far worse than that at Pearl Harbor —which, incidentally, is the first stop on our long journey to the Marshalls.

The primary purposes of this summer's tests, of course, are to gain information that will be helpful to the Navy in ship design, fleet tactics and the location of operating bases and repair yards. The air forces of both services will be in a better position to judge the effects of atomic bombs on aircraft, both airborne and grounded. The medical corps will learn more of the effects of atomic bombs on living beings in order to provide needed information on protection, diagnosis and treatment. As a necessary corollary to each of these objectives there will be accumulations of new scientific and technical information that will undoubtedly be useful in any peacetime applications of atomic energy or its radioactive byproducts. These are secondary considerations but it is already apparent that they are not going to be overlooked.

What about the costs? Before we left Washington we were told that the public's estimate of a half billion dollars is far above the actual facts of the case. That figure could only have been arrived at by counting in the original costs of all the ships, even though most of them are already scheduled for disposal as scrap or junk. On the basis of the present price of scrap and subtracting the cost of scrapping, we bring the total ship value down from over $400,000,000 to about $4,000,000. Other costs cannot yet be approximated but we are assured that the total operation, including transportation, food and salaries will undoubtedly be less than the cost of one new battleship. That much of the taxpayers' money may be saved many times over if the Bikini tests can teach us how to avoid investment in the wrong kind of ships in the future.

Today we are all asking a lot of questions. Within a few weeks the world will have most of the answers.

Sidney D. Kirkpatrick

San Francisco
June 12, 1946

JAMES A. LEE *Managing Editor, Chemical & Metallurgical Engineering*

# American Made Paper for Your CIGARETTES

**Cigarette paper making was developed in the U. S. just in time to replace the imported product which before the war had been coming to this country from France. As might be expected American engineers soon developed means whereby flax fiber could be used directly as a raw material rather than in the form of old linen rags. Furthermore, they were not content to follow in the footsteps of the French paper makers but immediately set out to find ways and means for improving the process and product. Today the plant has little or no resemblance to its French ancestor.—*Editors***

**Flax fiber is now used directly as raw material for cigarette paper**

UP TO within less than a half-dozen years ago, cigarette paper was made almost entirely from linen rags. The flax fiber, because of the ease with which it can be purified, combined with its peculiarly appropriate papermaking qualities, has long been preferred as a raw material for the manufacture of cigarette paper. However, prime quality linen rags were gradually becoming more and more difficult to obtain as the demand for cigarette paper grew, the situation having already become serious at the time of the first World War.

Harry H. Straus, who had had years of experience in the manufacture of cigarette paper, recognized the fact that sooner or later a method would have to be developed whereby flax fiber could be used directly as a raw material rather than in the form of linen rags, and with characteristic courage and energy instituted, about 12 years ago, research on the utilization of seed flax fiber for the manufacture of fine papers. After three years of intensive work in the laboratory and in the paper mill, he succeeded in making a number of successful commercial runs about 1937. At the present time several mills are making flax papers, of which the Ecusta Paper Corp. at Pisgah Forest is the largest producer, turning out approximately 50 tons of cigarette and other fine flax papers per day.

This mill was announced in May 1938 and completed in August 1939. It started out to be a $2,000,000 project, had expanded into a $12,000,000 plant last year, and is now undergoing a third expansion program. It was President and Founder Straus' clear vision of what lay ahead and his keen personal interest in fine papers that made cigarette paper available during the war period in quantities large enough to manufacture cigarettes for our armed forces, and the ever-expanding civilian needs. It was almost an act of destiny that the first commercial order for this all-American flax paper should have been completed on Sept. 2, 1939, the day after war broke out in Europe.

Cigarette paper must be about the thickness of a human hair, yet elastic and strong to withstand the pull of cigarette machines. A strip having a width equivalent to the circumference of your cigarette must support a weight of eight pounds. It must fold without tearing, it must not stick to the lips, it must burn at the same rate as tobacco, it must be opaque, pure white and, above all, tasteless.

Consumption of flax fiber by the several mills in the U. S. in 1937 was about 150 tons, increasing annually by 200 percent up to 1942, when it levelled off at about 52,000 tons. A small increase took place last year. It is expected that this level will be maintained in 1946, but on the basis of expansion in the industry now planned, it is estimated at least a 6,000 ton increase will take place next year. An annual consumption of 60,000 tons of fiber is expected, which will require about 300,000 tons of straw per year. From that point onward, consumption will depend on the increase in cigarette paper consumption, and the increased use of flax fiber in other papers.

Flax for the Ecusta mill comes from Minnesota and California, the former supplying the greater percentage. The California flax supplied by California Central Fibre Corp. is decidedly lighter in color due to more sunlight and irrigation; however, this difference has no effect on the volume of chemicals consumed in the processing.

Decorticated flax straw in 150 to 160-lb.

bales arrives at the Ecusta mill in North Carolina in railroad box cars. Bales are carried from the cars by portable conveyors to storage in large warehouses having a total floor space of five acres, or directly to the pulp mill. A year's requirements must be kept on hand because of possible crop failure. Two sources of supply are also insurance against shortage of raw material due to crop failure. From the warehouses the decorticated seed flax straw is handled on 24 and 36-in. belt conveyors to the pulp mill.

On arrival in the pulp mill the wires that hold the bale together are cut and the fiber is loaded into the rotary spherical digesters. These steel digesters are 1,165 cu. ft. in volume and have a capacity of 4½ tons of flax. The cooking solution is made up in large measuring tanks and mixed in another tank. It is then pumped into digesters.

The straw is cooked for five hours in the alkaline liquor with 75-lb. steam pressure. When the cooking operation is complete pressure is relieved, spent liquor is drained off, and the flax pulp washed with hot water.

The contents of the digester are dumped into a trench, sluiced down with water and then pumped into an agitated storage chest. An open impeller pump is used. This type of pump overcame trouble previously experienced in handling the fibers.

From the chest it is pumped to a cast iron breaker beater where the raw stock receives a final washing and the fibers are cut to proper length for this phase of processing. This operation requires three hours. The washed and beaten stock is dumped from the breaker beater into a channel or trench below the floor, whence it is pumped to a concrete storage chest. From this washed stock storage chest it is pumped to the bleaching system.

Bleaching is carried out in several stages: in the first, elemental chlorine is used; in the second, a caustic extraction is practiced; and in the third, the fiber is treated with hypochlorite. Washing is done by means of vacuum washers.

A Jeffery belt conveyor takes the stock to any one of 12 Bellmers, concrete chests with a mid-feather and agitation unit for circulation. Here the second stage of the bleaching occur. Unlike the first, this is a batch operation and calcium hypochlorite is used as the bleaching agent. It is run at a very slow rate so as to control closely the quality of the final product.

Wet weights of pulp in the bleach plant processing are determined by means of a Toledo Chronoflo Weightometer. Essentially, this consists of continuously totallizing weight of fiber being conveyed in rubber belt conveyors. This device is operated entirely electrically. In such control of the wet weights in combination with a rapid moisture determination, the mill is able to determine accurately and quickly the dry weight of fiber being processed in the second stage batch system. The dry weight control is necessary in order to add the correct amount of bleach liquor.

Briefly, the pulp mill control consists of bringing pulp into a narrower and narrower band of variation so that a uniform product is produced. Each step of the operation progressively narrows the limits of variation so that the pulp is delivered to the paper mill in a remarkably high degree of uniformity. Direct control is extensively used. In other words, control is applied so as to anticipate rather than correct.

The bleached stock is dropped out of the Bellmer at a definite point, as determined by control tests. It goes to a chest and is fed to and washed on a vacuum washer. The washed stock is conveyed directly to pulp storage.

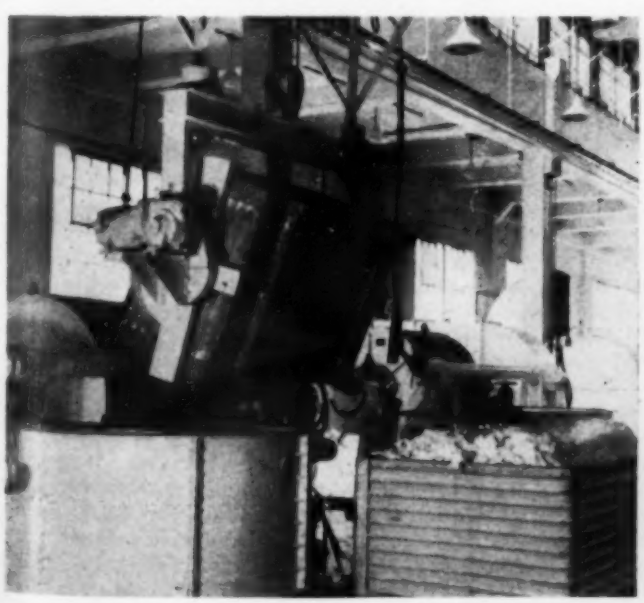
## PAPER MILL

In the paper mill stock is stored in shredded lap form in galvanized iron boxes which can be easily handled by electric lift trucks. This storage does not serve any purpose other than to supply a backlog to take care of break downs and delays due to other causes in the pulp mill. Ecusta has the largest single installation in this country of Jones-Bertram beaters. They have a capacity of 1,000 lb. each, the tackle is made completely of stainless steel, the roll weighs 12 tons, and there are three bed plates. All of these beaters are tile-lined cast iron which helps in maintaining cleanliness of product and aids in circulation of stock.

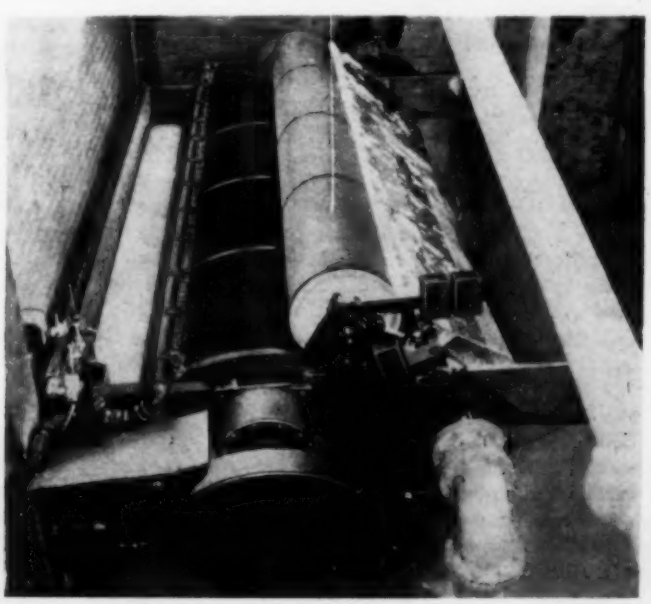
One of the unusual features of the Jones-Bertram beater is that once the stock has been handled and the proper beating action determined these operations can be reproduced by an electrically operated cam device. Each beater is equipped with a 150-hp. motor. The purpose of this beating is to cut the fiber into minute lengths and at the same time hydrate these fibers so that they will be in proper condition for forming a sheet of paper. Beating action brings out the inherent strength in the fiber. This is explained by the fact that the fibers are "frayed" which enables easy interlocking of the fibers when formed into a sheet.

When loading the beaters, the appropriate type of stock is selected and conveyed by electric truck to the aisle between the

**Charging stock in shredded lap form into beaters. They have a capacity of 1,000 lb. each**



**Vacuum washers are used to remove unreacted chemicals from stock before it leaves the bleach plant**



beaters from which an automatic crane picks up the box in its entirety, moves it into position over the particular beater to be loaded and automatically turns the box over, dumping the stock into the beater.

Great emphasis is placed in this department on control of each lot of stock being beaten. A fully equipped testing laboratory is maintained adjoining the beater room for this particular purpose.

The beaters are emptied by gravity into a machine chest where broke, filler, and water are added. The stock in this condition is constantly agitated by means of a spiral stainless steel ribbon.

Filler, precipitated calcium carbonate, is purchased to exacting specifications. The particle size and crystalline aggregates are closely controlled. Sufficient calcium carbonate is added in order to assure 22 percent in the finished paper. A carload is consumed every two days. The purpose of this filler is to enable the fibers to form a sheet of just the right tightness in order to give necessary porosity so that the paper in cigarette form will burn at the same rate as the tobacco, thus assuring desired combustion and ash.

Stock is pumped from the machine chest to an overhead stock box from which it flows by gravity through a jordan (125 h.p.). This completes the refining operation by smoothing out any irregularity or clumps of fibers. Stock flows from the jordans to a mixing box where it is diluted and mixed with white water returned from the paper machines. From here, it flows by gravity into a centrifuge where any foreign particles of a weight heavier than the pulp fibers are cast out and imbedded in a previously formed mat in the centrifuge.

Again by gravity flow, the stock passes through a series of screen plates having very small open slots. Any pulp accumulation or "fiber knots" are removed from the pulp here. The pulp fibers are now completely dispersed and flow by gravity to the machine headbox, and then onto the fourdrinier wire of the paper machines. There are eight paper machines, four have 112-in. wires, the others have 114-in. wires. They operate at 300 ft. per min.

## FOURDRINIER ACTION

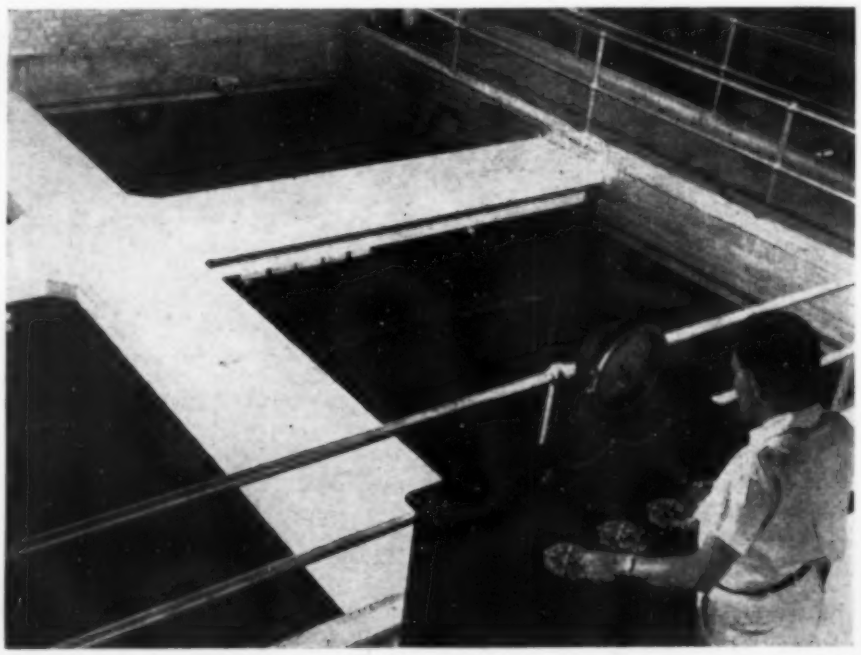
The fourdrinier wire is a finely knit mesh screen endlessly woven. The pulp suspension, which is over 99 percent water at this stage, flows over the wire, where a lateral motion called "shake" helps to interlock the fibers into an appropriately formed sheet. At the same time, the forward motion of the wire over a series of table rolls and suction boxes starts pulling out water by capillary action and vacuum, increasing the consistency of the sheet being formed so that when it leaves the wire it is sufficiently dry to be self-supporting. The wet web, as it is called, now passes onto a felt which carries it through press rolls to increase its consistency still further. The foregoing represents the wet end of the paper machine. Water drained from the wire is the "white water" previously mentioned which is recirculated.

The paper has been dried mechanically as far as possible when it leaves the press section. The web is now carried with the aid of felts through a series of steam heated dryer cylinders with controlled surface temperature. The paper is now dry and, after passing under a series of fluorescent lights where continuous rigid inspection is vigilantly maintained, is wound on a mandrel. When the diameter of the paper on the mandrel approximates 4 ft., it is transferred to inspection machines.

Extremely close specifications on cigarette paper make it necessary to control closely operation of the paper machine. This is done by checking the paper leaving the machine for thickness, weight, porosity, color, strength, opacity, and filler every hour, or more frequently at the discretion of the machine tender. Production samples are sent to the testing laboratory by a two-way pneumatic tube conveying system. Tests are instantly made and the findings are reported back to the operators in about three minutes. Tests numbers correspond to numbered tickets in each roll of paper from the machine. The laboratory is necessarily some distance from the paper machines so as to avoid excessive vibration and other conditions caused by the machines which would prevent accurate testing. This pneumatic conveyor is also connected with the superintendent's and main offices, and is used for correspondence between the laboratory and the various offices as well as for samples.

The inspection machine previously referred to serves for further observation of the sheet over fluorescent lights where any defects that are observed can be removed. Splices are made on this machine to join broken ends caused by washing up of the paper machine which takes place at frequent and predetermined intervals. The splices also join the paper at locations where regular samples have been taken out for testing purposes. Ecusta has developed a practical method of making splices with an overlap of less than 0.094 in. The inspection machine cuts the machine roll into two parts. The paper is then moved by elevator and dolly to the finishing department where the big rolls are transformed into tens of thousands of narrow reels, or bobbins, by a continuous slitting machine. This is truly a precision department for the width of the bobbins—approximately one and one-eighth inches—must be exact to fit cigarette making machines. Each bobbin is 6,500 yd. in length, weighs 8 lb., and is sufficient to manufacture 85,000 cigarettes. Each bobbin is labeled in such a manner that the paper can be traced back through the entire manufacturing process, to the raw materials, the operators who handled it, and the time at which it was made. The workers are highly trained. The building is spotlessly clean. After an additional rigid inspection the paper is packed into cartons and loaded directly into waiting freight cars for shipment to cigarette manufacturers.

Not all of the output is shipped to the cigarette manufacturers for use in making packaged cigarettes on automatic machines.



**Papermaking requires large volumes of water, 155 gal. per lb. of paper are used at Ecusta. This filter plant has capacity of 25,000,000 gal. per day**

Many large rolls of paper are conveyed to the adjoining plant of the Champagne Paper Corp., a subsidiary of Ecusta. Here the paper is cut in reams or made automatically into booklets for "roll your own" cigarettes. The average daily production in this department is 250 million cigarette leaves.

The activity at Champagne is an interesting trade barometer. When business conditions are good most smokers prefer machine-made cigarettes, and conversely, during lean years there is a great demand for roll-your-own booklets.

Two types of booklets are made. One is known as the "give away booklet" which is a loose leaf booklet containing from 12 to 24 leaves. The second type is the "5 cent booklet" containing 100 to 150 leaves. Most booklets contain a much lighter weight paper than that used for machine made cigarettes. This is necessary for ease of rolling and because the machines require a stronger paper. The entire operation is in continuous roll form from the printing to the point at which the paper is cut to size.

**In spherical, revolving digesters the fiber is treated with chemicals**

Ecusta is now making a line of fine flax writing and Bible papers of unusual texture and whiteness which are being offered by paper merchants throughout the United States.

Endless belts used in forming the cigarettes on cigarette machines throughout the world, except in England, are made by the Endless Belt Corp., another subsidiary of the Ecusta organization. Before the war the belts were made from linen, but cotton has now replaced the linen. After the belts are woven, they are stretched to desired length and treated with a mixture of starch, sizing, gums and oils.

Papermaking requires large volumes of water, 155 gal. of filtered water per pound of paper are used at Ecusta (the Cherokee Indian word for rippling water). Purity and adequacy of the water supply were the determining factors in location of the plant. The Davidson River which supplies the mill has for its water shed 40 sq. mi. of the Pisgah National Park. The mill is adjacent to the park so that no one will be able to build above it on the stream. The water is very soft and contains only 25 p.p.m. of dissolved solids.

The filter plant has a designed capacity of 20 million gallons per day. By pressing, the pumps can handle 25 million gallons (enough to supply a city of 150,000 persons). Roberts filters with Wheeler bottoms are used. There are ten sand and one anthracite filters. The average life of the filter beds between back washing is 3 to 4 days. A control board can detect trouble at any point in the filter plant. Alum and lime are used for flocculation, and prechlorination and post-chlorination are regularly employed, and ammoniation when necessary. At all times, 0.2 p.p.m. of chlorine are kept in the water, and a uniform pH is maintained.

In the purchasing and in the processing of partially decorticated seed flax straw, it is necessary to know accurately the moisture content of the baled flax. This problem of getting an accurate and rapid moisture content of a bale of raw, fibrous, cellulosic material has long irked processors of straw. When this problem arose at Ecusta, a search by the research division indicated that there was not a suitable method in use in the country. The usual methods of sampling and oven-drying are far too slow when carloads of bales are being handled daily.

## MOISTURE

An ideal method, as visualized by the laboratory, consisted of the application of some instrument which could be placed on the baled fiber and an instantaneous moisture content read on a meter. Thus the necessity of disturbing the bale would be eliminated, and a rapid moisture content of the shipment could be ascertained. Through the cooperation of the Moisture Register Co. of Alhambra, Calif., with the Ecusta Paper Corp., an electronic instrument, which uses dielectric leakage as its basis, was adapted to the testing of seed flax tow.

This instrument rapidly gives the moisture content of a bale of fiber by simply holding it firmly against the bale and averaging the readings at several points on the bale. The values thus obtained represent a true average moisture content of the bale contents, since the electrostatic field actually penetrates the bale.

The instrument consists of two parts: the gun, which is held against the bale of fiber, and the meter, which gives a direct moisture reading. The instrument is very rugged, requires but little maintenance, and is easily operated by unskilled help.

Among the interesting statistics about the plant are the following: (1) 1 kw. hr. of power is required to convey 1,000 gal. of water from the river through the filtering plant to the mill; (2) In winter the mill uses 138,000 lb. of steam per hr., and in the summer season 60 percent of this amount; (3) Process steam is used at 80-lb. pressure; (4) 160,000 kw. hr. per day of 24 hours are used; (5) The mill generates 80 percent of its power and purchases the balance.

The finished product of the Ecusta mill is remarkably uniform. This means that the process depends upon close control at every step. The importance of this is emphasized by the fact that the director of inspection and control reports directly to the general manager. The 150 men and women of the physical testing laboratory and inspection department eternally strive for perfection.

## RESEARCH ORGANIZATION

The management is justly proud of the research accomplishments, organization and facilities. There is one of the largest investments in research facilities for a company the size of Ecusta to be found anywhere in America. Under the able leadership of the late Dr. Fritz L. Straus, former director of research, the department was organized into fundamental research, applied research, and analytical work. And under the present direction of Milton O. Schur, the chemists and engineers are continuing to achieve outstanding results.

In view of the basic changes that have been made in raw materials and technological developments, which were underway in the domestic industry even before the war, and of the large expansion and heavy investment that have taken place in the industry, it seems probable that imports, now that the war is over, will furnish, at most, only a minor part of our domestic requirements; and they may actually be confined to relatively small quantities imported to satisfy special demands.

Most Americans have never heard of Ecusta. But every hour millions of Americans, as they light a Camel, a Chesterfield, a Philip Morris, an Old Gold, a Lucky Strike, or any one of many other brands, are handling Ecusta's product.

For this opportunity to witness the production of American cigarette paper from American raw materials with American labor, the writer wishes to express his appreciation to Harry H. Straus, president and general manager, Dr. Ward Harrison, assistant general manager, Lee M. Bauer, production supervisor and coordinator, Raymond F. Bennett, general superintendent, Milton O. Schur, director of research, R. E. Matthews, director of inspection and control, and A. M. Ream, technical superintendent.

For a pictured and diagrammatic flowsheet of this process the reader is referred to pages 138-141.

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# Industrial Applications of the HEAT PUMP

**The heat pump is a reversed heat engine in which energy is applied to raise the pressure and hence the temperature of a vapor. For many years engineers have played with the idea of using the heat pump for a variety of purposes including the raising of low level heat to higher temperatures for both space heating and for process uses such as distillation and evaporation. A recent application of the idea is the Kleinschmidt evaporator used extensively by the Navy for distilling sea water (Jan. 1946, p. 129). Improvements in heat transfer surfaces and in compression equipment have given applications of this principle renewed interest and a number of possible uses.—*Editors***

DEVELOPMENTS carried on during the war have opened up vast and seemingly unlimited possibilities for the advancement and improvement of power generating and power consuming equipment in the heat-power field. In this advancement and improvement, the heat pump is qualified to play an important part, particularly in industrial heating and cooling applications, because of its inherent characteristics for efficiently converting waste or otherwise unused natural heat into a more useful form.

The heat pump cycle is not new, nor is it revolutionary. In fact it can be considered as a reversed heat engine. The heat pump absorbs power to develop heat while the heat engine absorbs heat to develop power. The same familiar temperature-entropy diagram for the Carnot cycle (Fig. 1), which represents the maximum possibilities for the conversion of heat into work for a heat engine, can also be applied to evaluate the performance of a heat pump.

Referring to Fig. 1, for a heat engine cycle, the area under the horizontal line $T_h$ represents the heat added from an external source, and the area under the line $T_c$ equals the heat thrown away through the exhaust. The net area of the rectangle between $T_h$ and $T_c$ represents the energy taken out as work from the shaft of the engine. The thermal efficiency is given by the ratio of:

$$\frac{\text{Work output}}{\text{Heat input}} = \frac{T_h - T_c}{T_h} \quad (1)$$

For a heat pump cycle, the area below the horizontal line $T_c$ represents the heat taken in at the low temperature source, and the area below the line $T_h$ represents the heat rejected to the high temperature receiver. The area between lines $T_h$ and $T_c$ represents the work required to drive the pump. When used for refrigeration, the efficiency of the cycle, usually referred to as the "Coefficient of Performance" (COP), is given by the ratio:

$$\text{COP} = \frac{\text{Refrigeration effect}}{\text{Work input}} = \frac{T_c}{T_h - T_c} \quad (2)$$

The coefficient of performance of the cycle, when used as a heating machine, is given by the ratio of:

$$\text{COP} = \frac{\text{Heat delivered}}{\text{Work input}} = \frac{T_h}{T_h - T_c} \quad (3)$$

As can be seen from the temperature-entropy diagram, Fig. 1, there is no basic difference between a refrigeration cycle and a heat cycle—both are heat pumps. In the refrigeration cycle, the evaporator performs the chief function of removing heat from a space or object while, during the heating cycle, the condenser performs the chief function of supplying heat to a space or object.

It is informative to study Equation (3) for its significance. The higher the COP, the greater is the amount of heat delivered at the high temperature level for a given power input. Also, the COP increases as the difference $(T_h - T_c)$ decreases. This means that the higher the temperature of the heat source and the less the spread between the two temperatures, the higher will be the coefficient of performance.

A common equipment arrangement of the heat pump, consisting of an evaporator, condenser, compressor, and expansion valve, is illustrated by Fig. 2. The pump A compresses the low-temperature, low-pressure refrigerant gas from the evaporator B and delivers it to condenser C in the form of a high-temperature, high-pressure superheated refrigerant vapor. The vapor condenses in C giving up the latent heat of vaporization, plus the work of compression, to an outside medium. From the condenser, the liquid refrigerant goes through the expansion valve to evaporator B where it changes from a liquid to a gas by absorbing the latent heat of vaporization from an outside medium. From surface B the low-pressure, low-temperature gas returns to the compressor suction to repeat the cycle.

As an example of the potentiality of the heat pump as a heating machine, assume that a 50 deg. F. (510 deg. F. abs.) heat source is available and the heating medium is to supplied at 100 deg. F. (560 deg. F. abs.). By substituting in Equation (3), the COP = 510/(560 − 510) = 11.2. The coefficient of performance 11.2 means that for every kilowatt-hour input (3,413 B.t.u.) as work to drive the pump, there would be 3,413 × 11.2 = 38,225 B.t.u. per hr. of energy delivered at the 100 deg. F. temperature level. This is far in excess of the 3,413 B.t.u. mechanical equivalent of 1 kw.-hr. which would be delivered by the direct use of electrical resistance heating elements. The difference between 38,225 and 3,413 B.t.u. per hr. represents the tremendous margin of possible saving in fuel by the application of a heat pump in those services where temperature levels are not too high.

It should be particularly noted that the coefficient of performance, represented by Equations (2) and (3), and the example given above, is the highest possible theoretical performance between two limiting temperatures. The actual coefficient of performance is always lower than the ideal by as much as 40 to 60 percent. Part of this

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reduction is due to the temperature gradient necessary for heat transfer, to the losses involved in the work of compression, and to the thermodynamic cycle being polytropic instead of adiabatic, as in the ideal cases.

Even with present-day inefficiency of 40 to 60 percent, the actual coefficient of performance for the example cited (which may be from 4.5 to 6.7) is still quite attractive. As improvements and advancements are made in the design of heat transfer surfaces and compressor efficiencies, to give higher actual coefficients of performance, the heat pump will have many more practical applications as a heating machine.

As can be seen from Equation (3), the temperature level of the heat source $T_s$ will materially affect the resulting COP. Hence, for practical applications, a heat pump will offer a high potential economy only if relatively high temperature level heat sources are available.

## INDUSTRIAL APPLICATIONS

Application of the heat pump to the heating and cooling of homes, office buildings, and similar structures, has attracted considerable attention during recent years. Equal, if not greater, possibilities exist for the economical application of the heat pump in the industrial field. In many industrial plants the air temperature, humidity, circulation and cleanliness are controlled to maintain the most favorable working conditions, while in many others these factors are controlled primarily to improve the quality of the product. In the manufacturing of precision instruments, for example, uniform temperature conditions are highly desirable to maintain the close tolerances required; in spinning mills ample humidification of the air improves production by increasing the elasticity and strength of the fibers; in tobacco factories constant temperatures and humidities preserve the aroma, reduce wastage and improve both output and quality; in paper mills, printing and photographic work, temperature and humidity control aid materially in obtaining production uniformity. These and many more industrial processes where heating, cooling, humidifying and dehumidifying are required to maintain production standards offer real potentialities for the economical application of the heat pump.

The reasons for this are: First, the heat pump uses the same equipment for the heating and cooling cycle, in fact, heating and cooling can be supplied simultaneously; second, there are often several possible heat sources which will result in an exceptionally high coefficient of performance, such as water from rivers, lakes or wells, hot air saturated with steam given off during the manufacturing process, warm water used for cooling machines, and many other sources where the temperature is not high enough for direct utilization.

In addition to being used to supply both heating and cooling, the heat pump can in many cases be used effectively to furnish heat alone. An interesting application of the heating cycle alone is the use of a heat pump to increase the efficiency of a centralized heating plant. In this cycle, illustrated by Fig. 3, the heat absorbed from the heat source by the low temperature surface (evaporator *B*) of the heat pump is transferred by compressor *A*, together with the heat equivalent of the work of compression, to the water circulating through condenser No. 1 (*C*). The steam passing through the turbine is condensed by the water circulating through condenser No. 2. The power generated by the steam turbine can be used to drive the heat pump directly or through an auxiliary.

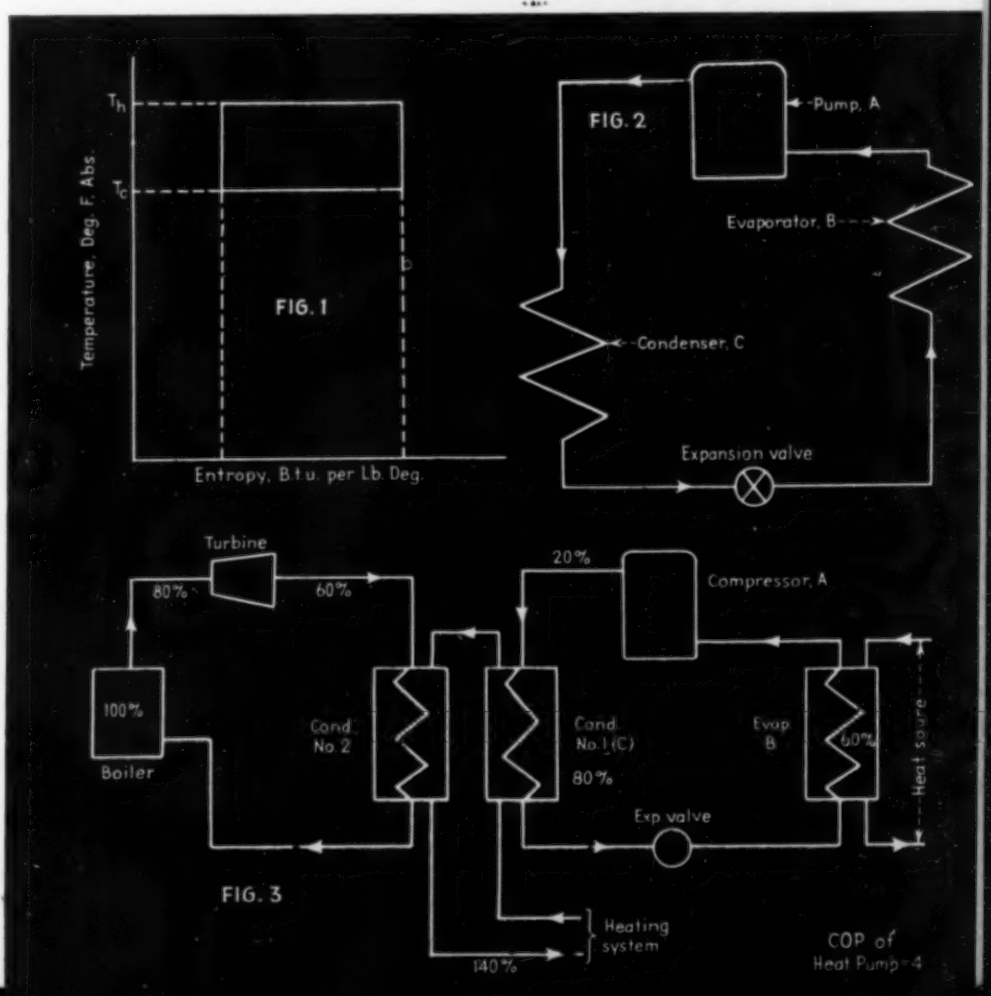
The water returning from the heating system goes through condenser No. 1 where it picks up the heat supplied by the heat pump, then through condenser No. 2, where it picks up the latent heat of the steam. From condenser No. 2, it is returned to the heating system to complete the cycle. If a coefficient of performance of 4 is assumed for the heat pump, together with the other efficiences given in Fig. 3, it is possible to get 140 percent more heat delivered to the heating system than is used by the boiler. This is about 2½ times more heat than would be obtained by a conventional byproduct steam turbine heating system, and 1¾ times that obtained by a low-pressure heating plant. This means for a given output the fuel consumption would be 55 to 60 percent of that for a low-pressure heating plant. Such a system is now in operation at the Swiss Federal Institute of Technology, Zurich, Switzerland, and was described in Brown, Boveri Review, July and August 1943.[3]

Another important class of industrial applications where the heat pump shows great promise lies in the evaporation and distillation industries, particularly in chemical and foodstuff plants, where salts or concentrates have to be recovered from solutions while reclaiming the solvent. Since heat quantities involved in such a process are usually large and the temperature differences are small, the use of a heat pump results in a high coefficient of performance. In a typical cycle, shown by Fig. 4, the thermocompressor *A* compresses the vapors taken from the solution to a higher pressure and temperature, and passes them through a condenser *B* located in the evaporator *C*,

**Fig. 1—Carnot cycle on the temperature-entropy plane illustrates thermal efficiency and coefficient of performance**

**Fig. 2—Simple heat pump cycle used for heating by reversed refrigeration**

**Fig. 3—Here low temperature waste heat and heat of condensation in a power cycle are combined to supply process heat**



where the steam vapor condenses, giving up its latent heat of vaporization to maintain the process. The steam condensate mixture then passes on to the preheater *D* where sensible heat is given up to the dilute solution on its way to the evaporator. The concentrated solution is taken out at the point marked "concentrate." The pounds of water which can be evaporated per kilowatt-hour at various vapor temperatures, and at various temperature differences between the evaporator and condenser, are shown by Fig 5.[2] It can be seen that 20-60 lb. of water can be evaporated per kilowatt-hour, depending on temperature of the solution in the evaporator, the nature and concentration of the substance, and the difference between the boiling point of the solution and the pure solvent.

The heat pump cycle shown schematically by Fig. 4 has great possibilities where an evaporating process is used, as in applications such as the concentration of dyes, the preparation of foodstuffs, and the concentration of unfermented fruit juices, condensed or powdered milk, table salt, and sugar.

## WATER DISTILLING

Such a heat pump cycle can also be used to advantage in distillation. One practical application, which has received considerable attention, is the production of drinking water by distillation from sea water.[3] Another possibility is the removal of impurities and foreign matter by distillation from the water used in manufacturing processes.

Operating results for several actual installations which employ the heat pump cycle in the evaporation and distillation field are shown in Table I. The coefficient of performance varies from 4.8 to 14.7, depending on the operating condition. The tabulation clearly shows that the higher the evaporation pressure and the smaller the temperature between the heating steam and the material to be concentrated, the higher the coefficient of performance will be.

Whether a heat pump installation will be more satisfactory and more practical than a conventional evaporator using steam from an external source, depends on a number of considerations. In using steam, it

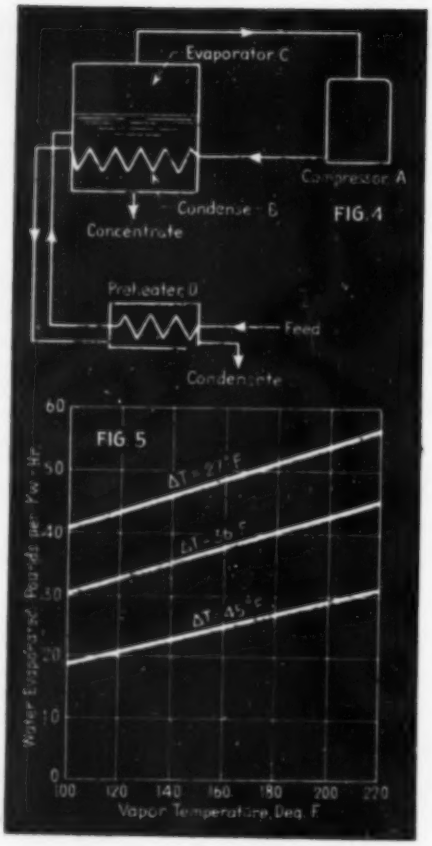



**Fig. 4—Compression distillation cycle as applied in the distillation of water and in certain industrial evaporations and distillations**

**Fig. 5—Pounds of water evaporated per kilowatt-hour at various vapor temperatures and various temperature differences between heating steam and vapor, using a heat pump**

is sometimes possible to use multiple effect evaporators, providing the maximum temperature in the evaporator is not limited. If however, it is necessary that the evaporating temperature be kept low and within narrow ranges in order to safeguard the delicate organic structure of the product, and to prevent loss of taste, aroma, flavor, and vitamin content, the multiple effect evaporator cannot be used.

Approximate capacity of single and multiple effect evaporators, per pound of heating steam supplied, is shown by Table II. The larger the number of stages into which the evaporating process is divided, the smaller the steam consumption. On the other hand, the larger the number of stages, the higher the initial cost. No generally valid rule can be laid down regarding the evaporating system to be preferred, since too many factors have to be taken into consideration. The most favorable solution must be arrived at by careful investigation into the conditions prevailing in each particular case. However, it is interesting to note that for Process (1) in Table I, the amount of steam required with a single effect evaporator would be 2,531 lb. per hr., and with a four-effect evaporator, steam consumption would be 917 lb. per hr., as against 73 kw. hr. (249,149 B.t.u.), when an electrically driven heat pump is used.

Industrial applications of the heat pump may be subject to a considerable amount of scepticism because of the prime mover drive required. Every prime mover implies a conversion efficiency of heat into work which is never better than 35 percent, even with the best and most modern power plants. A diesel engine drive in many localities is particularly weak on this score because of the additional burden imposed by the need for diesel fuel which is generally expensive compared to coal. In many cases, therefore, the diesel heat pump is uneconomical.

## WHEN USE IS JUSTIFIED

There is, of course, no thought of urging the heat pump as the economic successor to all prior methods. Rather, it must be recognized that each alternate method has some advantages and some disadvantages. Under any particular local condition there is one solution which is preferable. The heat pump may fit the specifications. Consider, for example, a requirement for heat at a relatively low temperature level, where electric energy from a hydroelectric development may be available at 1 mill per kw.-hr. Examples can be found where energy is offered for sale at such a price, particularly on a secondary basis. The direct cost for this energy would be 29 cents per million B.t.u. If used in a direct electric heating operation, this would be the operating cost equivalent for fuel. This utilization might be by resistance elements, infra-red lamps, induction furnaces, electric boilers, or the like. If on the other hand, a low tempera-

(*Continued on page 114*)

**Table II—Approximate Capacity of Single and Multiple-Effect Evaporators per Pound of Heating Steam Supplied[1]**

| Effects | Lb. Evap. per Lb. Steam — Forward Feed | Backward Feed |
|---|---|---|
| 1 | 0.869 | 0.869 |
| 2 | 1.51 | 1.60 |
| 3 | 1.95 | 2.30 |
| 4 | 2.41 | 2.95 |

**Table I—Operating Results In Evaporation and Distillation Installations***

| | Energy Input, Kw.-Hr. | Evaporative Capacity, Lb. per Hr. | Water Evaporation, Lb. per Kw.-Hr. | Approx. COP | Evaporator Temperature, Deg. F. | Suction Pressure, Psi. Abs. |
|---|---|---|---|---|---|---|
| 1. Evaporating plant handling milk products | 73 | 2,200 | 30.1 | 8.9 | 120 | ..... |
| 2. Evaporating plant handling milk products and unfermented fruit juices | 240 | 6,600 | 27.1 | 8.0 | 120 | ..... |
| 3. Evaporating plant in chemical works | 94 | 1,540 | 16.3 | 4.8 | ... | 0.86 |
| 4. Water evaporating plant for distillation of drinking water | 75 | 2,750 | 36.6 | 10.6 | 212 | 14.65 |
| 5. Water evaporating plant for distillation of drinking water from sea water | 6.6 | 390 | 59.0 | 14.7 | 213 | 14.65 |

* Data taken from References 1, 2 and 3.

**JOHN R. CALLAHAM** *Associate Editor, Chemical & Metallurgical Engineering, San Francisco, Calif.*

# Engineering Technique Commercializes Human BLOOD FRACTIONATION

**Sound engineering is as necessary for economic production of a pound of chemical drug as for a tank car of sulphuric acid. In the synthesis of chemotherapeutics, engineering techniques are contributing vital impetus to the life-saving sciences by improving quality, lowering costs and increasing output. Certainly no work is more valuable, few fields more promising to the chemical engineer. Recent applications of chemical methods in the industry have been brilliant successes; fractionation of human blood plasma is one of the latest.—*Editors***

DURING the war, human blood plasma became along with pencillin, sulfa drugs and other new theraputic agents, a major factor in saving many thousands of lives on the battlefronts. Of equal importance is the less-known fact that human blood has become the source of a number of high-molecular protein fractions for the field of therapeutics. Human blood is now a chemical raw material and blood fractionation, a chemical engineering technique that requires delicate manipulations and close control, becomes a member of our biochemical industries. The products, though small in volume, are of tremendous importance.

Human blood can be used in a number of ways, basically three: (1) As whole blood; (2) after centrifugation to remove the red and white cells, as a source of plasma to be stored in liquid form or in the dried state; (3) as the raw material, through fractional precipitation, of at least five commercial protein therapeutic agents. It is this last use that interests us the most.

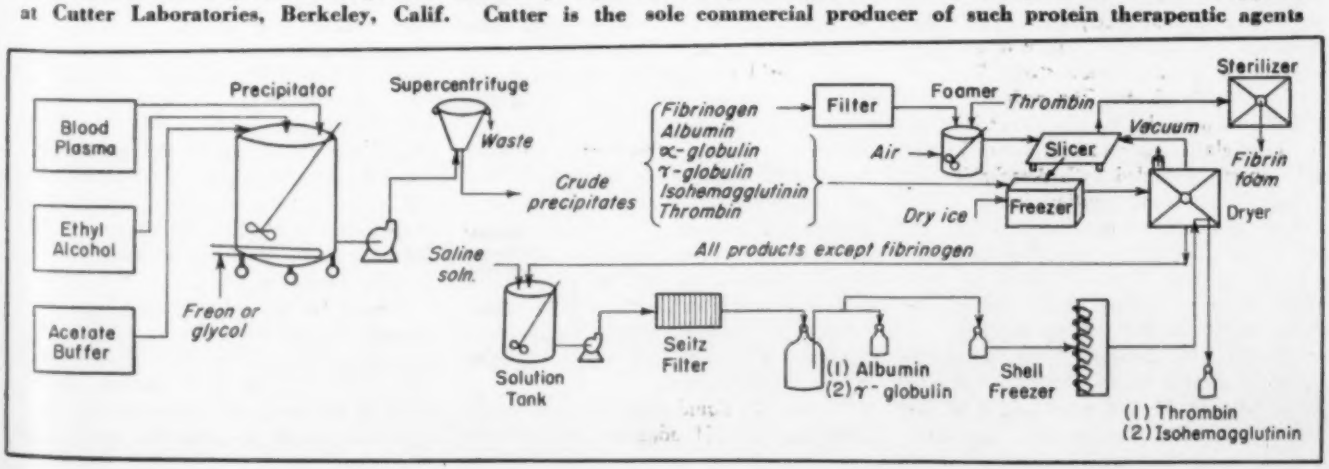
## THE BEGINNINGS

About 1935 researchers began giving serious attention to the possible use of dried plasma; liquid plasma and measles serum were then the only commercial products from human blood. Dried plasma was successfully used in 1938, then on a world-wide scale during the war.

Prior to Pearl Harbor, there had been some experimentation with albumin as a substitute for plasma in emergency treatment of shock. One of the chief researchers on this program was Dr. Edwin J. Cohn of the department of physical chemistry, Harvard Medical School. Later, working under the sponsorship of the Navy and the Office of Scientific Research and Development, Dr. Cohn and his associates worked out the present process of plasma fractionation. The method was first applied on a large scale during the summer of 1942. However, the albumin program was so urgent that little time was left for purifying other fractionation products. These crude fractions were simply stored for later purification and the pure products did not become generally available until the winter of 1944.

Originally on the albumin and blood fraction program were Eli Lilly & Co., E. R. Squibb & Sons, Sharp & Dohme, Inc., Lederle Laboratories, Cutter Laboratories and The Upjohn Co. Armour & Co. entered the program about a year later. These firms processed at the peak about 5,000 gal. of blood weekly. As the need for albumin became less urgent, the number of processors was reduced; by the end of the war only Cutter Laboratories and E. R. Squibb remained. At present, with the demands of peace only, the sole commercial firm producing albumin as well as the other plasma

**Generalized flow diagram of the process used for precipitation and purification of human blood plasma fractions as applied at Cutter Laboratories, Berkeley, Calif. Cutter is the sole commercial producer of such protein therapeutic agents**



**Movable glass-lined and stainless steel vessels are used by Cutter in the blood fractionation process; the Supercentrifuges are stainless steel 15,000 rpm.**

protein fractions is Cutter Laboratories, Berkeley, Calif.

## PROCESS AND EQUIPMENT

The entire process of plasma fractionation is based on the fractional precipitation of closely related proteins from alcohol-water systems at low temperatures and with accurate pH control. Variants in the process consist of alcohol content, acidity, total salts concentration and temperature. Operations at Cutter Laboratories are carried out in a cold room at −5 deg. C.; variations from this temperature are controlled by circulating refrigerated Freon or glycol through coils in the processing vessels. Violent agitation must generally be avoided.

Since most of the precipitations occur in an acid medium, stainless steel or glass-lined equipment is most commonly used although some of the tanks are plastic-lined steel. Heavy metal contamination of the blood fluid would precipitate or discolor most of the plasma proteins. Most of the reaction tanks are on wheels and can readily be moved about. Pumps and lines for transferring the plasma liquids are of stainless steel as are the batteries of 15,000 rpm. Supercentrifuges used throughout the process to remove protein precipitates. The three Seitz filters used for sterilization of all products are of special stainless steel. They are equipped with asbestos filter pads.

Initial steps of the batch process take place in open glass-lined tanks of about 75-100 gal. capacity provided with detachable side agitators. However, dilution increases the volume as processing progresses so that vessels increase in capacity up to about 350 gal. During the war, Cutter Laboratories fractionated on an average about 750 gal. of blood weekly in five separate batches.

Alcohol used throughout the process is generally diluted to 53 percent or less to avoid heat of dilution when added to the plasma. It also prevents any large contaminating growths. Acidity is controlled by addition of an acid or alkaline acetate buffer salt solution.

Both technique and equipment for freezing, desiccation through sublimation, and packaging are basically the same as those for penicillin and dried blood plasma. These have been described in the literature.

## FRACTIONATION TECHNIQUE

The fractionation process starts with whole blood chilled to 2-5 deg. C. This is centrifuged at 6,000-7,000 rpm. to remove the red cells, usually discarded since they can be preserved for only about ten days, as well as the white cells. The lighter layer, a mixture of proteins known as plasma, constitutes about 60 percent of the total volume of whole blood. The operating cycle of loading the centrifuge, balancing the load, centrifuging and unloading requires about 50 min.

Raw plasma, containing only 6.5 percent total proteins, has a pH of about 7.4 which must be adjusted to 7.0 with an acid acetate buffer and cooled to −2.5 deg. C. Simultaneously with chilling, ethyl alcohol is added until it reaches 8 percent by volume. Fibrinogen, representing about 7 percent of the total plasma proteins, separates out and is removed by continuous centrifugation at about 15,000 rpm. Fibrinogen removal is practically complete, and represents about 60 percent of the precipitated proteins. These molecules are fiber-like, being 20 times as long as thick.

Temperature of the supernatant liquid is lowered by refrigeration to −5 deg. C., more acid buffer added until the pH reaches 6.8 and alcohol added until it reaches 25 percent by volume. This dilution lowers the total protein content to about 3.1 percent by volume. A mixture of proteins constituting about 27 percent of all proteins in the raw plasma and designated as fraction II +III is precipated and removed by supercentrifugation at 15,000 rpm. This fraction, which must be processed further to remove gamma-globulin, isohemagglutinin and thrombin, will be discussed later.

Acidity of supernatant liquid II + III is lowered to a pH of 5.1 while the alcohol content is raised to 40 percent; the temperature is held constant. Under these conditions a mixture of proteins constituting about 8 percent of the original proteins is precipitated. Uses for this fraction are being investigated. However, by keeping the alcohol content and temperature of the supernatant mixture constant while raising the pH to 5.8 with an alkaline acetate buffer (bringing the total salts to 0.01 molar concentration, a critical factor in this fractionation), a precipitate of alpha- and beta-globulins is obtained. This constitutes about 8 percent of the plasma proteins.

Supernatant liquid from this last precipitation has its pH adjusted with an acid buffer to 4.8 ± 0.02. Under this delicate condition of acidity, temperature and alcohol being held constant, a precipitate is obtained that accounts for about 49 percent of the original proteins in raw plasma. While the filtrate is discarded, the precipitate is purified by dissolving in water and warming to −2.5 deg. C and then raising the alcohol content to 10 percent while maintaining a pH of 4.8. Insoluble impurities are removed by filtration while albumin is now precipated from the purified filtrate by chilling to −7 deg., raising the pH to 5.2 and bringing the alcohol content to 40 percent. Albumin is the fifth and last fraction to be obtained from the raw blood plasma. Largely responsible for the maintenance of blood volume, albumin is the most soluble and stable of the plasma proteins.

## FRACTION II + III

Fraction II + III previously mentioned consists of a mixture of alpha-, beta- and gamma-globulins, which must be further fractionated into relatively pure gamma-globulin and mixtures of alpha- and beta-globulins in which isohemagglutinin and thrombin are concentrated. In the first step of purification, the precipitate is suspended at a temperature of −5 deg., a pH of 7.2 and an alcohol content of 20 percent and then centrifuged to give a washing effect. The wash from this can be fractionated by an alcohol and pH adjustment into a fatty material, now discarded, about which little is known.

Precipitate from the above purification treatment is adjusted to an alcohol content of 6.9 percent (the most critical factor), a temperature of −2 deg., and a pH of 5.4. The protein content is thereby brought to 1.14 percent. Precipitate III resulting from these adjustments gives rise to thrombin and isohemagglutinin concentrates while the filtrate yields gamma-globulin.

The precipitate is warmed to 0 deg., while the pH is kept at 5.4. The alcohol content is now 0.55 percent and the salt content 0.08 molar. Under these conditions one small fraction becomes soluble which, upon further fractionation, yields the isohemagglutinin-containing globulin fraction known as typing serum. The insoluble fraction is purified by raising the pH to 6.4 and precipitating out a small amount of insoluble impurities. By raising the temperature of the purified soluble portion to 22 deg. C., the highest used in the entire fractionation process, and by addition of $CaCl_2$ and thromboplastin made from human placentas, the product thrombin is formed.

Filtrate III is purified from a very small amount of solid impurities by adjusting the temperature to −6 deg., the pH to 5.2 and the alcohol content to 17 percent. By increasing the total salt content of the purified filtrate while keeping other factors con-

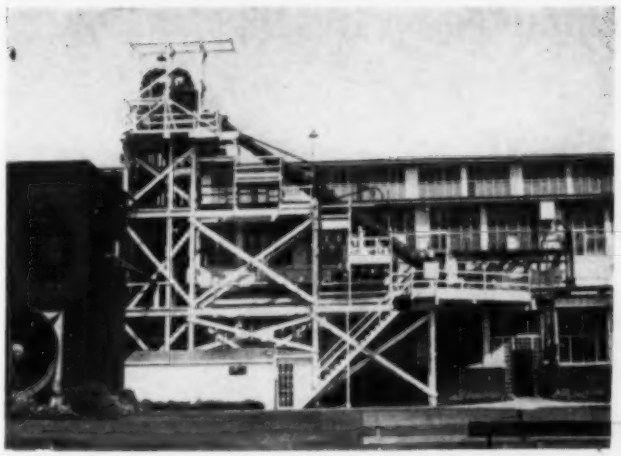
stant, relatively pure gamma-globulin can be precipitated and removed by high-speed centrifugation. This fraction contains about 60 percent of all the antibodies present in human plasma.

## PRODUCTS PURIFICATION

Crude products from the fractional precipitation process outlined above must be purified and processed into a stable and convenient form for storage and shipment. All products except fibrinogen are desiccated by freezing at —30 deg. C. and volatilization of water by diffusion pumps pulling about 150-200 microns on the drying chests. The temperature gradually rises as water and alcohol vapor is removed. The desiccating process and equipment are similar to those used for penicillin. The dried products are then dissolved in a weak saline solution and passed through a Seitz filter for final sterilization. Albumin and gamma-globulin are shipped in liquid form, while thrombin and isohemagglutinin are shell-frozen after sterilization and again desiccated. The purified dried products are stable and can be stored indefinitely.

Because of its nature, fibrinogen is processed in a somewhat different manner. It is first filtered through a Seitz, then mixed with air to a froth by means of small, high-speed electric agitators. Simultaneously, a very small amount of thrombin is added as coagulating agent. Slabs of the resulting foam, frozen by placing on dry ice, are then dried by vacuum desiccation in a manner similar to the other plasma products. The dry foam is then cut into small cubes and the desiccation continued for about two hours. It is then sterilized by a heat treatment in an oven for several hours at 170 deg. C. Temperature control is important, otherwise decomposition results. This foamed fibrinogen of Cutter Laboratories is known appropriately as fibrin foam. It is always used in conjunction with thrombin to form a valuable blood-clotting agent.

Of the five commercial products now derived from fractionation of human blood plasma, albumin alone had been prepared, and then for experimental purposes only, before the war. The remainder have been developed since mid-1942 and have become available to civilians only since September, 1945. Authorities in the field believe that more products will be developed until essentially all the constitutents in human blood will find uses in the field of medicine. After all, the science of blood fractionation is young and pioneering.



**This steam ejector, reportedly the world's largest, was used by Cutter during the war for drying human blood plasma**

Until synthetic substitutes can become competitive in price and properties to blood-derived proteins, a distant possibility because of the complexity of the protein molecules, human blood will remain the raw material for this unique and valuable biochemical industry.

*Albumin* — This fraction can replace plasma in treatment of shock where compact packaging is important, being approximately five times as effective on a volume basis. Not a complete substitute for plasma, it is used mostly in emergencies and in the Navy, where its small bulk is advantageous. In civilian medicine, albumin is used chiefly in the treatment of severe edema. Albumin protein is soluble in water and hence can be shipped ready for use in liquid form. Most stable of the blood proteins, it requires no refrigeration even in hot climates.

## USES

*Fibrinogen and Thrombin* — Used together, these products form the most remarkable blood-clotting agent yet developed. Thrombin, the actual coagulating chemical, is dissolved in a saline solution, after which foamed fibrinogen or fibrin foam, acting as the surface on which the blood can clot, is moistened with the thrombin solution. The dampened sponge, many times more absorbent than gauze, can then be applied to an open wound and left in place to be assimilated by the body tissues. These products have been especially valuable in delicate brain surgery.

*Isohemagglutinin*—Fastest and most potent reagent yet found for typing blood, isohemagglutinin shows up types and subtypes within a few seconds and makes proper transfusion a certainty.

*Gamma-globulin*—This fraction, containing most of the antibodies in human plasma, is a concentrated passive immunizing agent and at times even a complete prophylaxis against measles. Since it is effective in very small amounts and causes no unpleasant reactions, gamma-globulin has proved especially valuable in protecting small children from the disease.

*Alpha-globulin*—Still in the experimental stages, this protein may some day find a use as a suspending and preserving agent for red blood cells.

*Red cells*—Although red cells constitute about 40 percent of the volume of whole blood, no commercial use has been found for them, primarily because of the ease with which they break down. Experimentation on stabilizing these cells is being carried foreward.

Credit for supplying basic information for the preparation of this article is due Dr. Fred F. Johnson, director of chemical and pharmaceutical research at Cutter Laboratories, who has worked closely with Dr. Edwin J. Cohn of the department of physical chemistry, Harvard Medical School. It is through the courtesy of Dr. Cohn and the management of Cutter Laboratories that details of the process are here published, making this article one of the first public disclosures of the blood fractionation technique.*

**Table I—Conditions for Selective Fractionation of Human Blood Plasma [1]**

| Step | Fraction | Conditions of Precipitation[2] Temp., Deg. C | pH | Proteins, Percent[3] | Total Salts[4] | Alcohol, Percent[3] | Precipitate[5] |
|---|---|---|---|---|---|---|---|
| 1 | Whole plasma | −2.5* | 7.0 | 5.3 | 0.12 | .8* | Fibrinogen |
| 2 | Supernatant from 1 | −5.0* | 6.8 | 3.1 | 0.09 | .25* | Fraction II + III |
| 3 | Supernatant from 2 | −5.0* | 5.1* | 1.1 | 0.06* | .40* | Waste |
| 4 | Supernatant from 3 | −5.0* | 5.8 | 0.6 | 0.065* | .40 | Alpha-& beta-globulins |
| 5 | Supernatant from 4 | −5.0* | 4.8* | 0.4 | 0.075* | .40 | Precipitate V |
| 6 | Precipitate V | −2.5* | 4.8* | 3.0 | 0.01 | .10 | Waste |
| 7 | Soluble from 6 | −7.0* | 5.2* | 2.5 | 0.007 | .40 | Albumin |
| 8 | Fraction II + III | −5.0 | 7.2 | 0.61 | 0.0032 | .20 | Precipitate VIII |
| 9 | Precipitate VIII | −2.0 | 5.4 | 1.14 | 0.0064* | 6.9* | Precipitate IX |
| 10 | Precipitate IX | 0.0 | 5.4* | 2.0 | 0.08* | 0.55 | Precipitate X |
| 11 | Precipitate X | 0.0 | 6.4* | 0.67 | 0.20 | 0.18 | Waste |
| 12 | Soluble from 11 | 22.0 | 6.4 | 0.66 | 0.20 | 0.18 | Thrombin[6] |
| 13 | Supernatant from $11_a$ | −5.0 | 6.3 | 1.0 | 0.05 | .15* | Isohemagglutinin |
| 14 | Supernatant from 10 | −6.0 | 5.2 | 0.7 | 0.015* | .17* | Waste |
| 15 | Filtrate from 14 | −6.0 | 5.2 | 0.7 | 0.05* | .17* | Gamma-globulin |

[1] At Cutter Laboratories, Berkeley, Calif. [2] Most critical factors for each step are marked with an asterisk. [3] As percent by weight. [4] Total salts expressed as molar concentration. [5] Protein products are as crude precipitates and must be purified further. [6] After addition of thromboplastin and calcium chloride.

* See Jour. Amer. Chem. Soc., 68, 459, 1946.

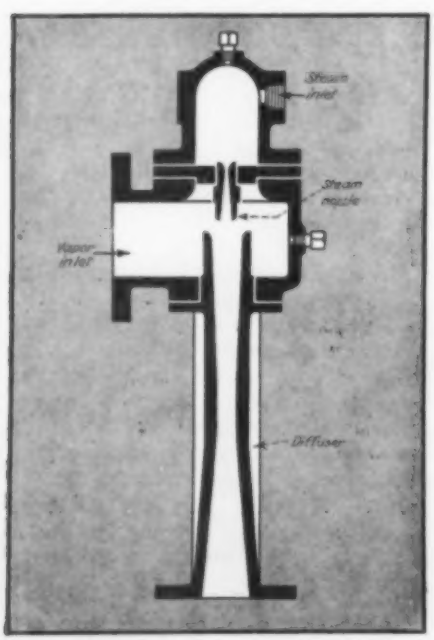
**PHILIP FRENEAU** *Engineer, Elliott Co., Jeannette, Pa.*

# How to Use Metering Characteristics of STEAM JET EJECTORS

**Although apparently simple devices, the characteristics of steam jet air ejectors are not well understood by many engineers, nor do most users realize that as long as an ejector is operating stably, it can be used as a metering device to determine the flow of vapor that is being drawn from an evacuated space. To do so it is only necessary to measure the suction pressure and read the discharge rate from the characteristic curve. The author shows this method in use and also explains the intricacies of characteristic curves.—*Editors***

CHEMICAL INDUSTRIES have used vacuum in production for many years. Early vacuum devices included the condenser, hand operated aspirators, water eductors and reciprocating vacuum pumps, which were a grown-up version of the aspirator. In recent years the demand has been for lower absolute pressures (higher vacuum), and more capacity. Higher vacuum has been met by development of efficient rotating vacuum pumps, diffusion pumps and steam jet ejectors. Higher capacity has been met by development of more efficient condensers, large capacity centrifugal compressors and steam jet ejectors. It will be noted that the steam jet air ejectors aid in both the modern trends of low pressure and high capacity. This article will attempt to show why they are fitted for such services.

**Fig. 1—Cross section of a typical steam jet air ejector**




## HOW EJECTOR WORKS

Shown in Fig. 1 is the basic ejector element in which high pressure motive steam is expanded through a de Laval type nozzle to convert pressure into velocity. The gases and vapors entering the suction diffuse into the high velocity stream. The entrained substance is accelerated while the motive stream is slowed down, the mixture (theoretically) reaching a common velocity before entering the diffuser. In the converging-diverging diffuser, the mixture velocity is reconverted to pressure, which at discharge is considerably higher than the suction pressure, but appreciably lower than the motive steam initial pressure. The process is continuous and there are no problems of clearance or displacement, as in compressors with moving parts.

## DECEPTIVE SIMPLICITY

In spite of the simple appearance of the ejector element, all parts must be carefully designed, machined and assembled. The relative position of the parts is quite critical; for example, omitting the gasket between the nozzle plate and mixing chamber, or using a thicker gasket, would seriously change the characteristic of the device.

A single ejector element works through a limited ratio of compression (discharge pressure divided by suction pressure), the economic limit being about 10:1, with the normal limit somewhat less. If greater than a 10:1 ratio is required, more than one element must be used in series. This 10:1 rule enables a simple check to be made on the minimum number of stages required to produce a given reduced pressure. Normally an ejector compresses from the reduced pressure desired to atmospheric pressure which can be assumed to be a maximum of 30.5 in. Hg abs. or in the metric system 775 mm. Hg abs. or 775,000 microns. Table I lists approximate data for maximum performance with from one to five ejector stages.

Practical considerations of operating economy usually suggest a lower compression ratio requiring more stages for the desired reduced pressure. Due to large free paths of

## SOME EJECTOR DEFINITIONS

***Suction condition*—Physical and thermal state of entering air-vapor mixture between suction flange and point of entrainment.**

***Discharge condition*—Physical and thermal state of mixture measured at discharge flange.**

***Motive steam condition*—Physical and thermal state of steam at entrance to nozzle.**

***Stability*—An ejector is stable when neither increase in steam pressure nor decrease in discharge pressure can cause a decrease in suction pressure for a given suction vapor load.**

***Stable pressures* — Maximum discharge pressure or minimum steam pressure for stable operation.**

***System pressure* — Back pressure caused by external factors acting on the ejector discharge.**

***Break*—Point at which ejector passes from stable to unstable operation.**

***Pickup*—Point at which ejector passes from unstable to stable operation.**

***Fluctuation*—Cyclic variation in pressure.**

***Bobble*—Rapid variation in pressure.**

molecules at extremely low pressures, the minimum values given for the five-stage machine are somewhat low although one or two experimental units have reported values of about the magnitude given.

An individual ejector element will have a characteristic curve similar to Fig. 2. The chart at the left shows percent capacity plotted against percent absolute suction pressure, and that at the right, maximum stable discharge pressure vs. suction pressure, both in percent. The significance of these curves is that as long as the actual discharge pressure is less than the maximum stable value for any given load and steam pressure, the ejector will produce a definite absolute suction pressure such as indicated on the left hand chart. This absolute pressure-capacity relationship enables an ejector to be used as a meter. If operation is stable and at a given steam pressure, it is merely necessary to read the suction pressure to enable the load being handled by the ejector to be read directly from the performance curve.

**Table I—Approximate Maximum Performance of Ejectors***

| | Number of Compression Stages | | | | |
|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 |
| Maximum economic compression ratio... | 10 | 100 | 1,000 | 10,000 | 100,000 |
| Minimum reduced pressure: | | | | | |
| In. Hg abs. | 3 | 0.3 | 0.03 | 0.003 | 0.0003 |
| Mm. Hg abs. | 77.5 | 7.75 | 0.775 | 0.0775 | 0.00775 |
| Microns (0.001 mm.) | 77,500 | 7,750 | 775.0 | 77.5 | 7.75 |

* Note: This table gives "economic limits," i.e., nearly shut-off values. Practical units at these extreme limits would normally have one more stage. In the extremely low pressure field this added stage would normally be a mercury or oil vapor operated diffusion pump.

**Fig. 2—Typical ejector performance curve for constant motive steam pressure, showing stable range and break point, for suction and discharge pressures expressed as percentage of design values**

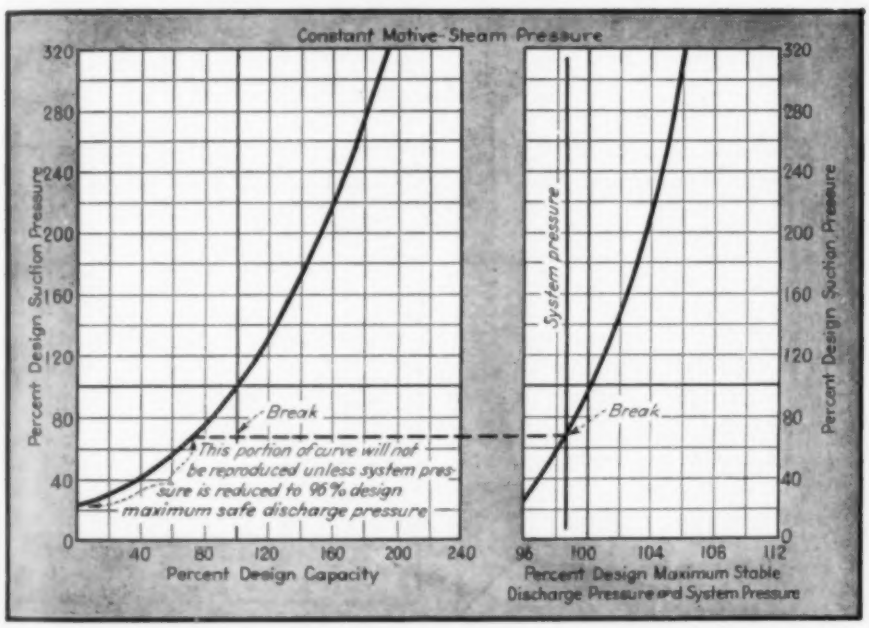



**Fig. 3—Typical ejector performance curve with three different motive steam pressures showing stable range and break point, for percent suction and discharge pressures**

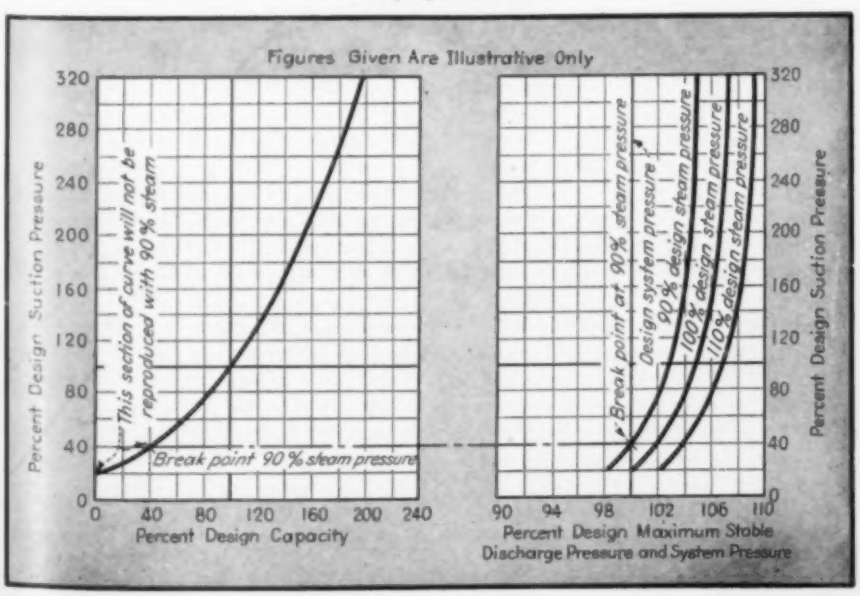
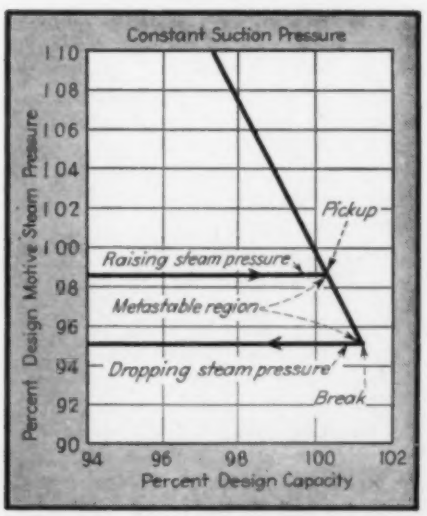



Fig. 3 shows the effect of steam pressure on the characteristic curve. The left hand plot is similar to that of Fig. 2 but the right hand graph shows the maximum stable discharge curves for three different steam pressures. Note that increasing the motive steam pressure enables the ejector to operate against a higher discharge pressure, while a lower motive pressure has the opposite effect. If we assume the actual discharge pressure (system pressure) corresponds to the 100 percent pressure line on the discharge pressure graph, it can be seen that the 100 percent (design) motive steam pressure curve lies to the right of the 100 percent discharge line and the ejector will operate stably regardless of the load. The 90 percent motive steam curve crosses the assumed discharge pressure line at about 40 percent of the design capacity.

If the load should drop below the 40 percent value, the capacity-suction pressure relation will no longer hold and the unit will "break," a condition marked by noise and fluctuation or "bobble" in the suction readings. At loads above 40 percent, operation will be stable. The 110 percent motive steam curve lies considerably to the right of

**Fig. 4 — Operation with steam pressure above the design value actually decreases the capacity of an ejector, while lower than design pressure causes approach to unstable operation (break point)**



the assumed discharge pressure line. This means that additional resistance could be put at the ejector discharge in the form of an exchanger, heater or long length of pipe up to the limit shown on the curve for 106 percent of design system pressure. Unless this resistance is actually present there is no advantage in operating at the higher pressure. A clogged steam nozzle reduces the motive steam flow and has the same effect therefore as reducing the steam pressure.

In Fig. 3 the curve for capacity vs. absolute suction pressure shows the same value for the three motive steam pressures. Actually this is not the case although the change in capacity is small. Fig. 4 shows that as the steam pressure is increased for a given load, the absolute suction pressure decreases. Reducing the steam pressure below the design value tends to cause an improvement in suction pressure but as reduction continues a value will be reached at which the unit will break. If the motive steam pressure is again increased the absolute pressure will not re-establish itself normally at the same steam pressure at which it broke but will require a somewhat higher value known as the pickup pressure.

## AVOID METASTABLE REGION

Between the break and pickup is a section on Fig. 4 that is known as the metastable region. Operation should be avoided in this region because if some local condition causes the ejector to break—a momentary drop in load for example—the unit will not re-establish the suction pressure when operation again becomes normal. The relative position of break and pickup with regards to the steam pressure is a function of the design of the ejector as well as the load on the unit. In our example of Fig. 3, the pickup pressure would be a function of the distance between the maximum stable curve and the actual discharge pressure.

A few actual examples will illustrate the use of the performance curves. Fig. 5 shows a standard ejector designed to compress 100 lb. per hour of air at a suction pressure of 8 in. Hg abs., using motive steam at 90 psi. ga. With this motive pressure the maximum stable discharge pressure is shown in the curve labeled 90 psi. ga., while other curves show the effect of 100 psi. ga. steam and 85 psi. ga. steam. The effect of this steam pressure variation on capacity is too slight to be shown.

Assume this ejector is placed on a vessel and a discharge pressure of 30.5 in. Hg abs. is read with 90 psi. ga. steam. This value is less than the maximum stable pressure so the capacity-suction pressure relationship for stable operation will hold. The suction pressure is now read and found to be 6 in. Hg abs. Referring to Fig. 5, it is found this corresponds to a load of 70 lb. per hour of dry air at 70 deg. F. If the substance being handled is near 70 deg. F. and its characteristics are similar to air, the actual weight will be 70 lb. per hour. In any case, its air equivalent is 70 lb. per hour. The unit could be replaced safely with one having 70 percent of the actual capacity and steam consumption, and still maintain the desired 8 in. Hg abs. pressure.

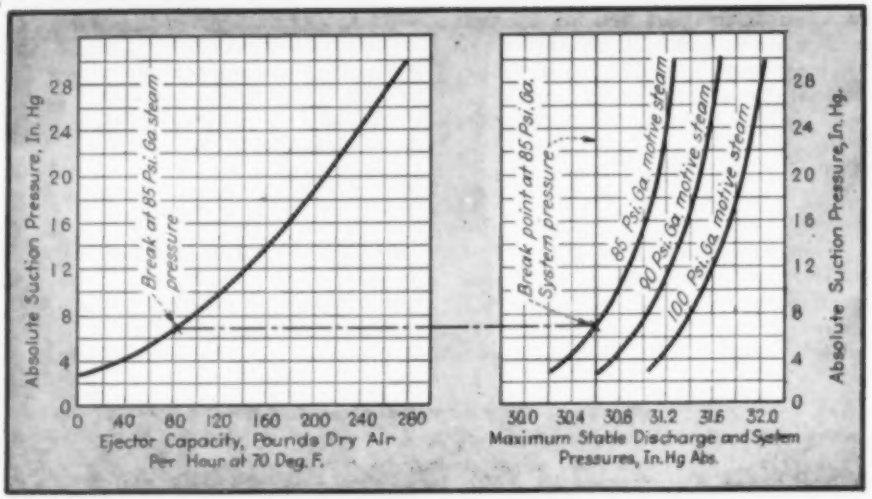



**Fig. 3—Performance curve for a typical ejector having a capacity of 100 lb. per hr. of dry air at 70 deg. F., with suction pressure of 8 in. Hg, using 90 psi. ga. motive steam**

Assume the same ejector is used on a new process and it is desired to employ the unit as a "tell tale" on the process. The first step is to determine the air in-leakage. This is done by pulling a vacuum on the system, empty and dry, until the pressure is well below the critical (i.e., below 15.5 in. Hg abs. with a 30 in. Hg barometer). Close the valve between the vacuum system and the ejector and note the rate of rise in absolute pressure. A rate of rise of 1 in. Hg per hour represents 2.5 lb. of air per hour in-leakage, or 0.55 c.f.m. of free dry air per 1,000 cu. ft. of volume. Expressed as a formula:

$$W_a = \frac{\Delta P \times V \times 0.00252}{S} = \frac{\Delta P \times V \times 0.151}{s}$$

where $\Delta P$ = rise in absolute pressure, in. Hg; $V$ = volume of system under vacuum, cubic feet; $S$ = time to produce $\Delta P$, hours; $s$ = time to produce $\Delta P$, minutes; and $W_a$ = free air leakage, lb. per hr. The limits of $P$ must be below 0.53 times the barometric pressure (i.e., below the critical).

Repeat the test with the ejector shut off and also with it operating beyond the closed valve to eliminate the effect of leakage at this point.

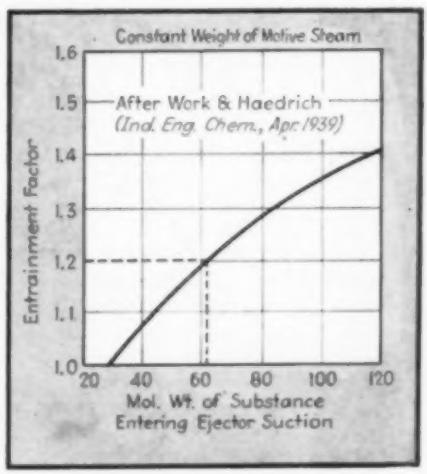



**Fig. 6 — Curve showing effect of molecular weight on performance of ejectors rated in terms of air handling capacity; for example, a unit handling 100 lb. per hr. of air would have a capacity of 120 lb. per hr. of material of 61 mol. wt.**

After the leakage has been determined, operate the ejector on the normal process and take absolute suction and discharge pressure readings as in Table II. If the dis-

**Table II—Data Recorded in Test on Release of Volatiles in a Process**

| Time | Motive Pressure, Psi. Ga. | In. Hg Abs. Barometer | Suction | Discharge | Rate, Lb. per Hr. Total Air Equiv.* | Volatile air Equiv.† | Remarks |
|---|---|---|---|---|---|---|---|
| 8:30 a.m. | 92 | 30.04 | 10.0 | 30.34 | 123 | 116.15 | Process started 8:00 a.m. |
| 8:45 | 92 | 30.04 | 9.12 | 30.34 | 114 | 107.15 | Jacket steam, 40 lb. per hr. |
| 9:00 | 91 | 30.04 | 8.24 | 30.34 | 106 | 99.15 | |
| 9:45 | 90 | 30.05 | 7.90 | 30.35 | 98 | 91.15 | |
| 10:00 | 91 | 30.05 | 7.75 | 30.35 | 93 | 86.15 | Jacket steam, 60 lb. per hr. |
| 10:30 | 91 | 30.05 | 7.70 | 30.35 | 92 | 85.15 | |
| 11:00 | 90 | 30.06 | 7.66 | 30.36 | 91.5 | 84.65 | Jacket steam, 100 lb. per hr. |
| 12:00 | 91 | 30.06 | 7.66 | 30.36 | 91.5 | 84.65 | Process completed |

* Air equivalent load taken from characteristic curve for various suction pressures.
† Calculated from air equivalent load by subtracting 6.85 lb. per hr. air leakage from each value.

charge pressures are less than the stable maximum, read the air equivalent load, corresponding to the existing suction pressure, from the characteristic curve. Subtracting the leakage determined from the leakage test then gives the release of volatile matter under vacuum, in terms of its air equivalent.

For example, assume the following readings are obtained using the ejector described in Fig. 5. The system volume is assumed to be 250 cu. ft. The average drop in pressure for the leakage test shows 4 in. Hg in 22 minutes. Then:

$$W_a = \frac{4 \times 250 \times 0.151}{22} = 6.85 \text{ lb. per hour}$$

The actual process shows the results recorded in Table II. The rate of release from the process is thus found for several time intervals and if rate is multiplied by the time duration for each interval a close approximation of the weight removed from the batch can be found. This weight should closely check the measured loss of batch weight during the process. If the volatile matter removed is at an elevated temperature or its characteristics are much different from air, the inventory weight loss and calculated weight loss may differ appreciably, but in the usual case there will be good agreement. An additional analysis should be made of the volatile matter to determine the percentage of condensables at the suction conditions.

## SAVING WITH CONDENSERS

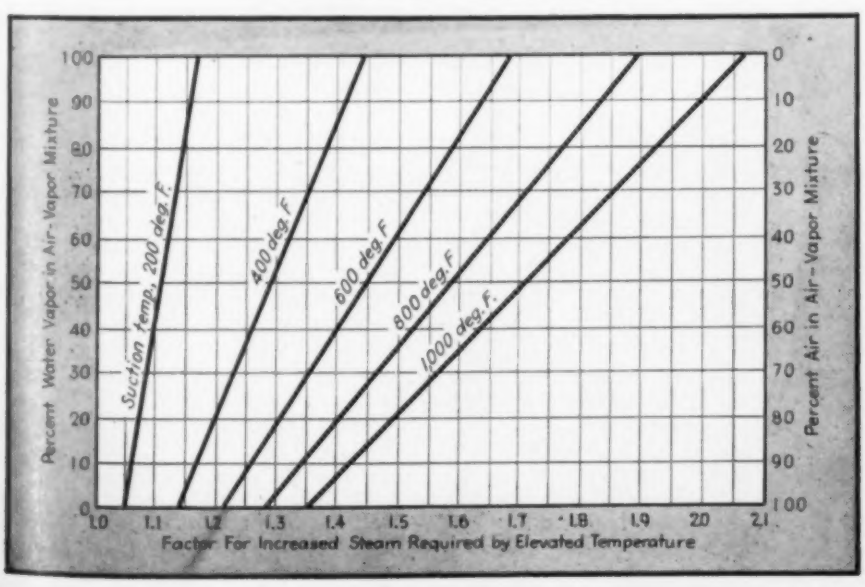
It should be remembered that the cheapest way to maintain vacuum is by the use of a condenser as it is much easier to pump a liquid from low absolute pressure to atmosphere than a vapor. The use of a precondenser either of the direct contact or surface type will usually show large operating cost savings. A direct contact condenser using a barometric leg for water removal is usually preferred to a surface condenser as it requires less water to produce a given pressure, cools the leaving gas more efficiently and is cheaper in first cost and maintenance. A surface condenser is justified only where the condensable matter has money value, where there is insufficient height for a barometric water leg or where recovery of the heat of the motive steam and the resulting condensate is important to the plant heat balance.

The foregoing example shows that operation is stopped at a final suction pressure of 7.66 in. Hg. Reference to Fig. 5 shows that with a 30.36 in. Hg abs. discharge pressure, the unit will operate stably with 85 psi. ga. steam at this suction pressure, thus enabling steam economy to be obtained if desired. If an after-condenser were employed, it would probably add extra system pressure and operation at 100 psi. ga. pressure might be required. A quick check on the system discharge pressure would show if this higher pressure were satisfactory.

The term "air equivalent" has been used several times in this article and it may be well to define the meaning and use of this concept. Ejectors are usually tested with air as the load, as it is plentiful and easy to measure. The weight handling ability of the unit is affected by the temperature and molecular weight of the gas compressed. In general, the lower the temperature and the higher the molecular weight, the greater the weight entrained and compressed per pound of motive steam. Fig. 6 shows the effect of molecular weight. These data are predicted from experiments of Work and Haedrich (*Ind. Eng. Chem.*, Apr. 1939). In the near future it is expected that an extensive research program will be undertaken, in which various ejector manufacturers will cooperate, to secure authoritative information on the effect of molecular weight and temperature. The data of Fig. 6 are on the ultra-conservative side. Fig. 7 shows the effect of increased temperature on the entrainment of air and water vapor. By referring to the air test of the unit and applying corrections such as shown in Figs. 6 and 7, performance with substances other than air can be predicted. It is important to note that under the same temperature conditions any given substance will be entrained by the ejector in a fixed percentage of air entrainment so that a few spot checks of actual weight balance compared with the ejector air equivalent weight will give the percentage correction.

After-condensers are often used to condense the exhaust of an ejector. The after-condenser has no effect on the steam consumption of the unit. It is used only for heat or product economy or to prevent contaminated vapor from being released to the atmosphere. Sometimes after-condensers are used to reduce the noise of operation but usually a muffler will prove cheaper and as satisfactory for this purpose.

**Fig. 7—Effect of suction temperature on steam consumption of ejectors handling mixtures of air and water vapor**




## CONSTRUCTION MATERIALS

Due to the simplicity of construction of an ejector and the fact that no moving parts are employed, it is possible to use materials of construction unsuited for reciprocating or rotating machinery. For example, graphite can be used for handling corrosive vapors. Other materials such as porcelain or possibly heat resistant plastics may be used. Due to the scrubbing action of the motive steam metals that rely on protective films for chemical inertness are not satisfactory for handling corrosive vapors. Simplicity of construction makes large size ejectors fairly simple to build. Many single stage units built for refinery service take from 15,000 to 20,000 lb. of steam per hour and handle about 6 tons of air per hour at 10 in. Hg abs. The smallest practical single-stage units will use in the range from 25 to 30 lb. of steam per hour.

In general ejectors are custom built for the particular job they are to perform. The actual design involves over 14 variables so really "standard" machines are rather impractical. In order to specify a unit properly, the capacity, absolute suction and discharge pressures and the minimum steam pressure should be given. If the material handled is corrosive this fact should be noted in the specifications.

Generous sized suction and discharge lines should be used to minimize pressure drop and a steam gage should be installed close to the unit to check the operating pressure. An ejector will not work well with wet steam so a separator should be installed to eliminate moisture if necessary. A properly specified and installed ejector is light, compact and requires little attention. Its ability to meter loads is an added feature which can be used to advantage in plant control.

EDITORIAL STAFF REPORT

# Scientific and Technical Preparations for the ATOM-BOMB TESTS

**Prior to taking off for next month's scheduled tests of atomic bombing, Admirals Blandy and Parsons of the Joint Army-Navy Task Force One, held press conferences in Washington to explain some of the scientific and technical features of "Operations Crossroads." Since these experiments will provide technical information and data of interest to engineers and scientists as well as to the Armed Forces, *Chem. & Met.* presents the following report of these official conferences.—*Editor***

VICE ADMIRAL W. H. P. BLANDY, U. S. N., Commander Joint Army-Navy Task Force One, announced at a press conference in Washington May 13 that the atomic bomb tests scheduled to take place at Bikini Atoll in July "are being conducted as fact-finding scientific experiments for future guidance with no interest to 'prove' or 'disprove' any present-day theories concerning military, air and naval strategy and tactics." He further assured the press that all possible facts consistent with the national security will be released promptly so that the public need have no misapprehension as to the nature of the tests nor any misconception as to their significance.

Early in the planning stages of the tests it was clearly recognized that no one test or series of tests could at the same time: (a) simulate war conditions, (b) provide the data which are desired from the purely scientific point of view, and (c) provide the data which are essential if military and naval strategists, engineers, designers and medical officers are to have the information they need in order to proceed along sound and economic lines in developing our Armed Forces.

The basic directives required that the Bikini tests provide the essential data needed by the Armed Forces. The tests are primarily planned, therefore, to determine and to measure with precision what happens at various distances when an atomic bomb is used against ships and other items of military equipment such as tanks, airplanes, radio sets, etc. Much information of value to science and technology will also be obtained, and where practicable, duplication or simulation is made of typical operating conditions.

The arrangement of the ships in the target array for the first test was reached after many factors affecting the problem were carefully analyzed by the Army and Navy and by civilian scientists. The array agreed upon is considered the best which will obtain the maximum of valuable information. It is so arranged that (a) maximum damage will be inflicted on the cluster of ships at the point of aim by one airplane dropping one bomb, and (b) a progressive decrease in damage will be inflicted on ships at increasing distances from the explosion to a point where it is intended that almost negligible damage will be encountered by ships farthest from the aiming point. A typical target array that closely approximates the exact location of the ships involved in the first test was shown by Admiral Blandy in the accompanying diagram.

In the first test about 75 targets will be exposed including more than 60 naval vessels divided approximately as follows: 5 battleships, 2 aircraft carriers, 4 cruisers, 8 submarines, 17 destroyers and 24 attack transports.

The atomic bomb which will be used in both of the tests in 1946 is the so-called "standard" type which was used at Nagasaki. According to Admiral Blandy, "It is the best type which we have available and that is the reason it is being used. There is no desire on the part of the Joint Chiefs of Staff or the personnel conducting Operations Crossroads to 'hold back' a more powerful bomb. If a more powerful bomb were now available, it would be employed."

Rear Admiral W. S. Parsons, U. S. N., Deputy Task Force Commander, in charge of technical direction, described some of the scientific aspects of the tests at an earlier conference on April 23. "Knowledge of the measurable factors of fast nuclear reactions or the phenomena connected with the explosion of atomic bombs, is limited to that secured as a result of the instrumentation at the Almagordo atomic bomb test last July and the two atomic bombs dropped by the Twentieth Army Air Force on Japanese cities last August. Naturally, in the case of the drop over in Japan, instrumentation was limited. In the tests at Bikini we are concerned with both the evaluation and analysis of damage to ships, equipment and material, and with every possible measurement of the phenomena incidental to the detonation of the bomb. Personnel for the staff section concerned with instrumentation have been provided by the Manhattan Engineer District and other Army and Navy agencies. In addition, civilian governmental agencies, universities and scientific institutions have contributed a number of scientists."

In so far as bomb operations are concerned, the responsibility will be that of the Los Alamos Laboratory of the Manhattan Engineer District which will deliver two bombs ready for use. The director of that laboratory is Dr. N. E. Bradbury, and the

***Chem. & Met.* and the other McGraw-Hill publications will be officially represented at the Bikini tests by Philip W. Swain, editor of POWER, who sailed on the press ship U.S.S. Appalachian from Oakland, Calif., June 12. Two other McGraw-Hill editors will see the tests but not cover it. S. D. Kirkpatrick, editor of Chem. & Met. goes as a non-participating scientific observer and Donald G. Fink, executive editor of Electronics is a member of the Navy party aboard the electronics control ship.**

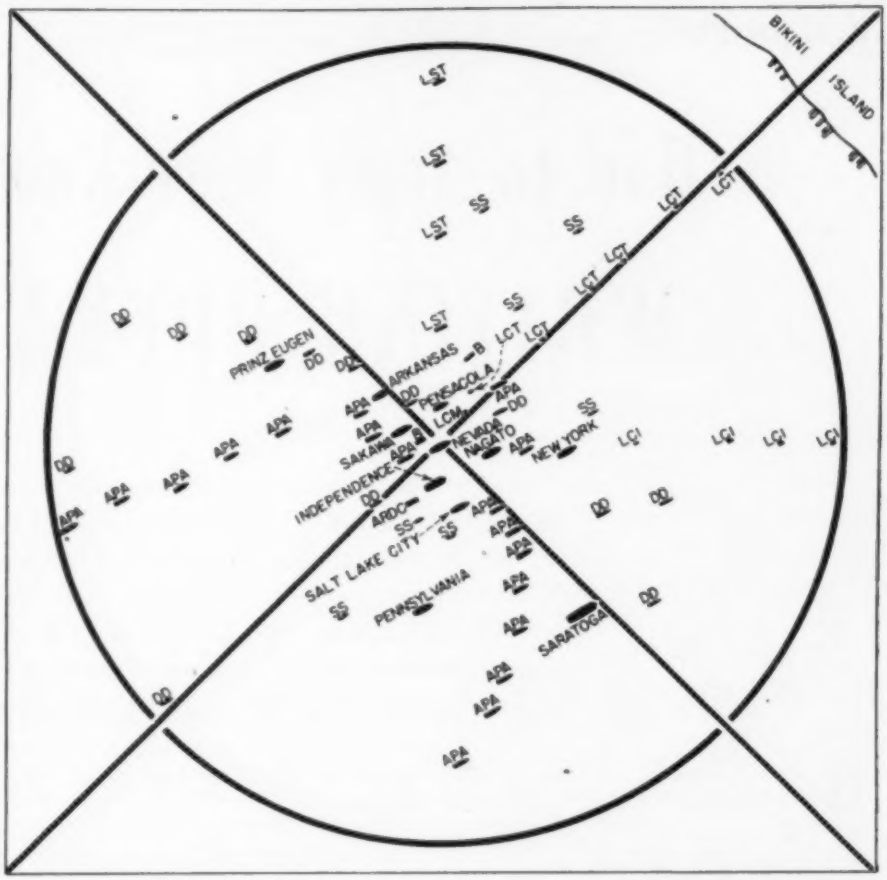
Los Alamos representative responsible for the bomb assembly is Roger Warner.

The section of the technical staff concerned with the measurement of flash, pressure and shock is composed of civilian scientists from the Los Alamos Laboratory, civilian and service personnel from the Navy Department of Ordnance and Ships, as well as a Navy drone unit from the Carrier U. S. S. Shangri-La and an Army Air Force drone unit. Instrumentation is required to measure air flash, under-water pressure, shock-wave velocity, by the Bureau of Ordnance parties who will be concerned primarily with pressure shock in free air and water (independent of ship structures) as functions of distance and time.

The most numerous instruments will be ball crusher gages and aluminum foil meters. The former measures air pressure by the deformation of a soft copper ball by a steel piston in a narrow cylinder. The latter measures air pressure by the rupture of aluminum foil. Other instruments will measure underwater pressure-time curves, peak pressures and shock-wave velocity.

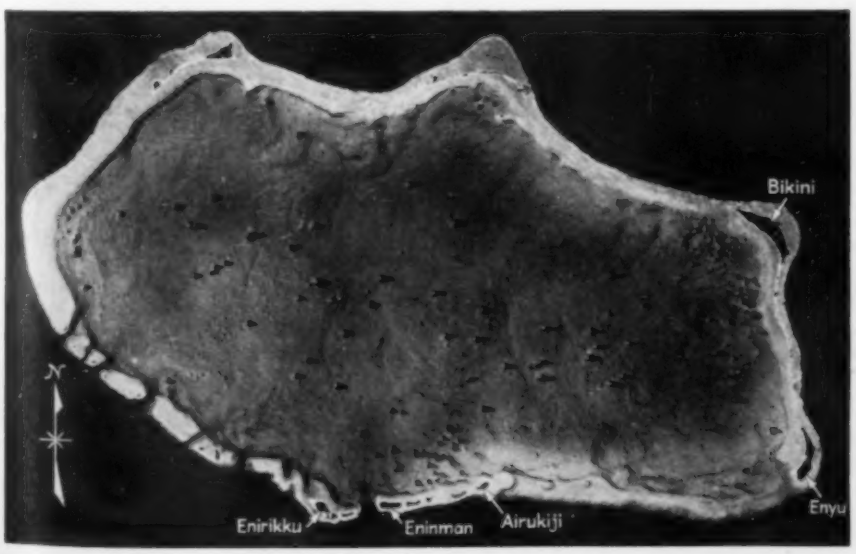
Electromagnetic propagation and electronics are coordinated by Dr. E. W. Thatcher, with the work carried on by Captain C. L. Engelman of the Navy Bureau of Ships and Colonel D. F. Henry of the Army Air Forces. They will make studies of the effects of the atomic bomb explosion on the propagation of electromagnetic waves. Colonel S. L. Warren of the Manhattan Engineer District will be in charge of radiological safety. This includes the responsibility for measurement of radiological phenomena in areas to be entered by various personnel and for tracking the movement of radioactive air and water masses caused by the blast. Radiation is under the direction of Dr. M. Holloway of the Los Alamos Laboratory.

Admiral Parsons concluded his conference with this statement: "Reports prepared by the various sections of the instrumentation staff will be submitted through the technical director of the Task Force Commander. He in turn will make them available to the Joint Chiefs of Staff's Evaluation Board and the President's Evaluation Commission. On the judgement of these two agencies, based on observation of the tests themselves in consideration of the scientific findings, the final evaluation of Operations Crossroads will rest. It is the responsibility of the technical staff to see that these agencies are provided with as full scientific record as possible.




**This is approximately how ships will be arranged in target array at Bikini**

It has been estimated that about 42,000 people will be involved in the Bikini tests—90 percent of whom will be Navy personnel. There will also be about 1,000 people in the groups that carry out the instrumental tests and measurements. Approximately half of these are civilian scientists and the remainder are technical officers and personnel from the Army and Navy. Both university and industrial laboratories will serve as contractors in providing specialized equipment and personnel and also in carrying out the various tests. It is estimated there will be 10,000 instruments involved.




**Bikini Atoll and Lagoon in relief**

**Bikini Atoll is about 500 miles south of Wake Island, in the Marshalls at Lat. 11° 31′ N. and Long. 165° 34′ E. The atoll is 21.5 miles long and includes over 20 islands of which Bikini is the largest. The comparatively shallow lagoon, averaging about 20 fathoms depth, is studded with "coral heads," shown in the relief map, many of which have been blasted out.**

**B. H. HOPKINS** *Chemical Engineer, Detroit, Mich*

# How to Apply More Know-How to WRITING OPERATIONS

**Technical writing is an important part of an engineer's job. Many engineers, however, tend to shy away from this phase of their work on the mistaken grounds that it isn't engineering. Quite the contrary, written reports are often the only record of a man's achievement upon which his professional progress may partly depend. Herein, the author outlines some points to consider in performing this engineering function.—*Editors***

HAVING TROUBLE with your writing? Do your reports fail to express your exact meaning? Do you feel that the chore of writing is ruining a good engineer? Then, perhaps you haven't looked at your own manuscripts critically enough to see their more obvious flaws.

Typical faults betrayed by the writings of engineers are: (1) Insufficient exploration of reader-audience and reader interest; (2) hazy understanding of purpose of writing each specific manuscript; (3) anxiety to start writing before all materials have been collected and sorted; (4) lack of discrimination in determining relative importance and

**Table I—Reader Survey**

1. **Who are the readers?**
   - a. Known to you?
   - b. Or unknown to you?
   - c. How many of them?
2. **How well do you know them?**
   - a. As individuals?
   - b. As groups?
   - c. On basis of what common interests?
3. **How well do they know you?**
   - a. From previous contacts?
   - b. How well do they recognize your authority?
   - c. Can you write directly toward any individual as typical of the group?
4. **How much of your language do they know?**
5. **How much of your subject do you want them to know?**
   - a. From common knowledge for information?
   - b. Of new knowledge for information?
   - c. Why is this new knowledge important to them?
6. **How capable are they of understanding your important points?**
   - a. What analogies will best illustrate your points?
7. **Where do you meet them?**
   - a. On common ground?
   - b. On their ground?
   - c. How formal must be the approach?

**Table II**
**Subject Evaluation**

1. **Why choose this subject?**
2. **How urgent or timely is it?**
   - a. Is your interest high or low?
   - b. Is the reader's interest high or low?
   - c. Is action pending upon completion?
   - d. Does it cover an investigation being discontinued?
   - e. Has the subject short-life or long-range interest?
3. **How came you to be an authority?**
   - a. Intense personal interest?
   - b. Possession of personally acquired new information?
   - c. Strong feelings demanding expression?
4. **What is to be accomplished by an additional report?**
   - a. Rounding out the record?
   - b. Correcting misconceptions in the record?
   - c. Informing a new and uninformed audience?
   - d. Changing established custom significantly?
   - e. Persuading to new belief?
   - f. Assuring adequacy of status quo?
   - g. Warning of serious consequences resulting from neglect?
   - h. Proposing new, important action?

pertinence of ideas; (5) overloading article with too many subsidiary thoughts that weaken attention placed on important ideas; and (6) reluctance to assume strongly critical attitudes in revising manuscripts.

These flaws are common to novice writers. However, the mechanics of good writing can be learned. Faced with the necessity for writing salable material or else, professional writers liquidate those habits that sap reader interest and assume techniques that improve their writing abilities. Engineers can acquire a similar know-how.

Many habits, hints, and helps, extracted from writers' opinions on the art of writing are shown in the following tables.

Tables I, II and III consist of three series of check-list questions. Reader survey focuses attention on reader interests and capacity to understand subject matter. Subject evaluation answers two questions: "Why write at all?" and "Why is this subject important, now or ever?" Consideration of timeliness and urgency gives the writer better perspective. Material selection aids in picking those ideas most effective in presenting the subject to the reader.

These three series of questions will help the engineer-writer to frame a better conception of why, for whom, and what material to use in a particular writing task. The process of answering before writing prepares his own mind before he attempts to influence others.

Table IV carries an outline of craft "secrets" that can be very helpful. The details are laid out in engineering terms. In fact, the actual writing process can be organized into typical engineering functions: Design, manufacture, process inspection, product inspection, and packaging.

Design covers the old familiar outline, the writer's equivalent of a set of blueprints. The importance of design cannot be overemphasized. Scarcely any fault reveals itself in poor writing more frequently than the lack of imagination and lack of forethought in planning.

Product inspection demands the highest standards of performance. Salvage and touch-up of sound, rough forms are not merely permissible. They are essential. Even though this calls for sterner discipline than the engineer usually applies to his writing, this high quality inspection only matches his customary standards in technical work.

Habits formed by using material covered in these questions and operations will give the engineer different viewpoints on know-why and different techniques in know-how of the art of writing. Although this habit-forming practice may not make a polished fluent writer of him, it can lead the engineer to better craftsmanship, to an expansion of his creative imagination and thinking capacity, and perhaps, to greater personal advancement.

## Table III
## Material Selection

**1. What new material do you have?**
- a. What part is fact?
- b. What part is opinion?

**2. How does it fit into existing common knowledge?**
- a. Confirming?
- b. Disproving?
- c. Supplementing?
- d. Forming a minor contribution?
- e. Forecasting major changes?

**3. What has already been said on the subject?**
- a. Who handled it?
- b. Before what audience?
- c. Are all the facts recorded?
- d. Are all significant opinions expressed?
- e. How well has the subject been covered?

**4. What remains to be said on the subject?**
- a. New facts to be disclosed?
- b. Stated opinions to be supported or refuted?
- c. Are these new facts or opinions worth stating?

**5. How much common knowledge can be incorporated?**
- a. How much is needed to set up your points?
- b. Is it duly credited to sources?
- c. Have the readers any prejudice against including common knowledge?

**6. What is the best approach to use?**
- a. Direct reporting?
- b. Historical development?
- c. Interpretation of significance?
- d. Challenge to new thinking?

## Table IV—Sequence of Operations in Manuscript Preparation

### SCRIPT DESIGN

**1. Group related items, ideas, and opinions.**
- a. Write each idea on a separate slip of paper.
- b. Reduce all data to final form and list conclusions to be drawn from them.

**2. Pick items for special emphasis.**

**3. Determine length of script.**
- a. Determine interest span of readers.
- b. Ascertain acceptable length from typical reader.

**4. Arrange items in outline form.**
- a. Put main points early, saving one strong point for end.
- b. Juggle order to secure continuity of flow and interest.
- c. Let naturalness and individuality guide within these limits.
- d. Abide by known reader habits.

**5. Give proposed vocabulary a quick mental inspection.**
- a. Reduce number of unfamliar words; aim at ratio of 4:1 familiar: unfamiliar.
- b. Eliminate prejudice-invoking words.
- c. Substitute short, synonymous words.

### SCRIPT PRODUCTION

**1. Write first draft from outline.**
- a. Work at top speed.
- b. Let it write itself.
- c. Minimize interruptions; segregate yourself, if possible.
- d. Mix fact and feeling.
- e. Reach for the active, vitalizing verb.
- f. Save rough spots for revision.

### PROCESS INSPECTION

**1. Quick-check first draft.**
- a. Are all ideas incorporated?
- b. Did you say what you wanted to say?
- c. Do you mean what you said?
- d. How fast does it read back?
- e. How smooth does it flow?
- f. Has it the makings for revising?

### PRODUCT INSPECTION

**1. Revise, if worth revising.**
- a. Let rest a day or two, if schedule permits.
- b. Read quickly for flow and interest.
- c. Check order of arrangement.
- d. Look for ideas out of order.
- e. Check correctness of grammatical construction.
- f. Substitute active verbs for participial phrases.
- g. Check for consistency of tense.
- h. Decide what parts can be trimmed to meet 10, 20, and 40 percent condensations.
- i. Ask question: Where can it be improved?
- j. Execute answer to that question.
- k. Ask second question: Where else?
- l. Execute answer to that question.
- m. Guinea pig the revision on some relentless critic.

**2. Re-revise.**
- a. Repeat cycle of operations in previous inspection.

### PACKAGING

**1. Have revised script copied in clean, easily read form.**

**2. Send promptly to intended audience.**

S. HORMATS *CWS Technical Command, Edgewood Arsenal, Md.*

# German Process for Manufacturing ACTIVATED CHARCOAL

**An interesting phase of the German chemical industry is the manufacture of activated charcoal. This article, based on the author's observations and interviews while on a military mission in Germany during August 1945, describes the important processes used by leading manufacturers.—*Editors***

MAJOR uses for activated charcoal in Germany were: military respirators, solvent recovery, and decolorizing and water purifying. Four major processes were employed to manufacture activated charcoal as follows:

| Type of Activation | Activating Agent | Carbonaceous Material Generally Activated |
|---|---|---|
| Chemical | $ZnCl_2$ | Peat |
| Chemical | $K_2S$ | Peat |
| Chemical | KCNS | Peat |
| Gas | $H_2O$ | Beechwood charcoal |

Variations from the above, e.g., gas activation of peat, were used also, but only to a limited extent. Some research had been carried out on the production of activated charcoal for military respirators from coal, but the results had not been satisfactory in that military specification requirements could not be met.

## ZINC CHLORIDE ACTIVATION

Information on the zinc chloride activation process was obtained by inspection of the I. G. Farbenindustrie Aktiengesellschaft plant, Leverkusen, and interview with personnel there. The method had been developed prior to 1939 and, except for certain modifications in the production of respirator charcoal, was represented as having been used without change during the course of the war.

The I. G. zinc chloride process could be applied to the activation of sawdust, wood charcoal, peat, and similar carbonaceous materials. However, it was stated that carbonaceous materials such as sawdust and wood charcoal resulted in activated products with pores of too-large diameter for the desired adsorptive capacity of toxic gas at low partial pressures. Therefore, only peat was used for the manufacture of respirator charcoal.

### RESPIRATOR CHARCOAL

Delivery to the plant is either by rail or barge. At the plant the peat was ground by passage through a Utica or similar German type hammer mill provided with a 1.5 mm. diameter mesh outlet screen. The true particle size of the material from the mill is considered to be much less than 1.5 mm. diameter, but because of a tendency to agglomeration the true size is not known with certainty. Careful control of fineness of grinding is considered by I. G. personnel to be unimportant. The ground peat is conveyed pneumatically from the mill to storage bins.

Zinc chloride is delivered to the plant in tank cars, as a 45 percent solution. Except for requiring the solution to be of somewhat less than the equivalent chloride to zinc content in order to decrease corrosion, no precise control was applied to the quality of the material used.

Either dough mixers or pug mills, made of steel, are used for mixing the $ZnCl_2$ solution and the peat. These materials are fed to the mixers at rates calculated to give a ratio of 70 parts of peat to 30 parts of 100 percent $ZnCl_2$. Certain of the original mixers are jacketed but it was found that heating was not necessary—a sufficient exothermic reaction occurring during mixing to raise the temperature of the mix to about 50 to 60 deg. C. Neither the time nor temperature of mixing are carefully controlled, the criteria for an adequate mix apparently being to run long enough to insure complete contact between the $ZnCl_2$ solution and the peat, and at a high enough temperature to yield a plastic product.

From the mixers the material is transferred on conveyors into vertical hydraulic multiple-orifice extrusion presses. These are in pairs, one press being loaded while the other is being operated. The presses are built of steel, not specially designed but of a type used for the production of spaghetti. About 110 liters of mix are extruded per batch, at a pressure of 150 kg. per sq. (approximately 2100 lb. per sq. in. The diameter of the extrusion is 2.2 mm. for normal respirator purposes but might be varied with the use intended for the final product. It was stated that larger diameter extrusions would make no appreciable difference in the quality of the product as measured by the capacity for adsorbed gas, although the rate of absorption would be slower than with finer extrusions. Extruded "spaghetti" drops into the hopper of a bucket conveyor leading to the inlet of the preliminary activator.

### PRIMARY ACTIVATION

Preliminary activation is conducted on a continuous basis in brick lined, countercurrent flow, direct gas fired, horizontal rotary kilns which were 20-27 m. long by 1.5-2.0 m. internal diameter. Retention time is about 2 hours. Inlet temperature of the heating gas is 900 deg. C., maximum carbon temperature 700 deg. C., with the temperature of the evolved gas about 200 deg. C. The evolved gases, essentially moisture, $ZnCl_2$, and HCl, are passed to multiple scrubbing towers for recovery of the $ZnCl_2$ and HCl. The steel recovery towers are lined with acid-resistant brick lined for scrubbing the initially hot gases, and rubber lined for the cooler gases. Recovered solution from the towers is pumped into cast iron tanks for concentration. These tanks, originally procured for concentrating sulphuric acid, are direct gas heated and are said to last 1 to 1.5 years before requiring replacement. Charcoal from the preliminary activator kiln is dropped into metal cans for cooling and transporting to the leaching section of the plant.

Leaching is conducted in acid-resistant-brick lined vats, each holding about 2000 kg. of charcoal. The vats were originally provided with paddle agitators but these were discontinued and pumps provided for recirculating washing liquors through the beds

of material. The contents of each vat are first treated with hot 3 percent HCl to react with and dissolve zinc oxides. The acid solution is then drained and pumped to the $ZnCl_2$ recovery system. The material is then washed with hot water to remove the chlorides. Removal of zinc is considered to be easily accomplished, control on the washing operation being, rather, a test for residual HCl. A solution of $CuSO_4$, of concentration depending on the copper content desired in the finished product, is then added to the vat and circulated until sufficient copper had been absorbed by the granules. Addition of copper is for the purpose of improving the adsorptive properties of the charcoal for hydrocyanic acid gas. The contents of the vat are next treated with a 5 to 6 percent solution of $K_2CO_3$ or KOH, then washed to give a product of 2 to 3 percent alkali content on a $K_2CO_3$ basis. Leaching and impregnating generally requires 24 to 36 hours, after which the washed and impregnated charcoal is removed manually and dried by passage through a small direct-fired, unlined, rotary kiln at a temperature of 120 to 150 deg. C.

## SECONDARY ACTIVATION

The product at this stage of the process possesses a high adsorptive capacity for gases such as $CCl_4$ and $C_6H_6$ when dry and at high relative pressures. However, it had been found that when humidified or when tested at low relative pressures of gas, its adsorptive properties were low, thus making the charcoal unsatisfactory for use in respirators. Calcination at elevated temperatures or a secondary activation with steam were found to correct these deficiencies materially, presumably through a modification in the surface complexes of the carbon. Accordingly, the production of carbon for respirator purposes was revised to include a second activation step. This second activation is conducted in a rotary kiln similar to that for the first activation, at a maximum carbon temperature of about 850 deg. C., using about 8 kg. of steam per kg. of product produced. The final product is cooled, screened, then generally sprayed in a rotary tumbler with pyridine and aqueous $AgNO_3$, respectively for improving the protection given against cyanogen chloride and arsine. Separate atomizers are used for each phase of this treatment.

The capacity of the unit plant described above is 2 metric tons per 24 hour day, with an overall yield of 20 to 22 percent charcoal and 2 to 3 percent fines on an air-drier peat basis. Fines from the process are sold as decolorizing carbon and not reworked, because of possible damage to the extrusion press equipment.

## SOLVENT RECOVERY CARBON

Production of activated charcoal at I. G. for solvent recovery uses is similar to that for respirator charcoal. However, requirements for adsorptive quality, particle size, and hardness are not as critical as for respirator charcoal, permitting a considerable reduction in plant control and the use of wood, wood charcoal, and other possibly less expensive carbonaceous materials in addition to peat.

The peat and other carbonaceous materials, either separately or in mixture, are ground in the same manner as for respirator carbon, and mixed in the same type of mill with about the same ratio of zinc chloride solution. However, the precise proportion of zinc chloride is not of as great importance and is not as carefully controlled as for respirator charcoal production. The plastic mixture is dropped into continuous, horizontal, "meat-grinder" type extruders placed directly beneath the mills, and the extruded 4-5 mm. diameter strands conveyed to an activating kiln similar to that used for the primary activation of respirator charcoal. Cutting of the strands is unnecessary, sufficient breakage apparently occurring during activation. Operating conditions of the kiln are the same, and the calcined product was treated with hot 3 percent HCl and washed in the same type leaching equipment, as for respirator charcoal. Washing is generally conducted until the carbon is free from acidity, with no subsequent alkali treatment, although this might be varied if desired.

The washed granules are dried in the same manner as for respirator charcoal. Since the solvent recovery carbons are generally intended for use in relatively high partial pressures of vapor and relatively dry atmospheres, the secondary activation step is not required. The dried carbon is screened and packed for shipment. Overall yields and plant capacity are the same as with respirator charcoal.

## DECOLORIZING CARBON

Peat, sawdust, and other similar raw materials, selected apparently on the basis of availability and cost, were used for producing decolorizing carbon. The ground material is mixed in a pug mill, using 1 part of peat or sawdust to 2 parts of $ZnCl_2$ solution. The mill is located directly above the inlet to a kiln of the same type used for the primary activation of respirator charcoal, the mud-like mixture dropping directly into the kiln. Operation of the kiln is similar to that for primary activation of respirator charcoal, and at the same temperature.

Material from the kiln is washed in the same manner as for solvent recovery carbon. After washing, the wet slurry is pumped to a ball mill and wet-ground to pass a German No. 80 (6400 mesh per sq. cm.) sieve. From the ball mill the material is passed to a rotary filter, and the filter cake then dried. Drying takes place at 100 deg. C. in a vertical disc-dryer using steam-heated discs, of the type used in Germany for drying brown coal. The dryer at Leverkusen, containing 10 discs, was built by the Benno Schilde Maschinenbau A. G., Hersfeld. It was stated that other type dryers had been used and operated satisfactorily, but this type was preferred because of economy of operation.

## $K_2S$ AND KCNS ACTIVATION

As stated above, it had been found by the Germans that unless a second activation or calcination step was used, $ZnCl_2$ activated charcoal was unsatisfactory for respirators because of poor adsorptive properties in humid atmospheres and at low partial pressures of toxic gas. The secondary treatment is of some benefit, but the product is still not completely satisfactory. Means for producing a more satisfactory carbon were examined by I. G. and it was found that the use of $K_2S$ instead of $ZnCl_2$ resulted in considerable improvement in the product. A process was developed for the manufacture of respirator charcoal by the $K_2S$ activation of beechwood charcoal, coconut shell charcoal, fruit pits, and peat, and plants utilizing the $K_2S$ process were erected at Premnity and Langelsheim by the Deutschen Aktivkohlegesellschaft in 1942.

The Deutschen Aktivkohlegesellschaft was the controlling combine for the I. G., Degusa, and Metalgesellschaft for Germany for military gas mask charcoal business. According to the Leverkusen personnel, the KCNS process was originally developed by an independent concern as a subterfuge for using the $K_2S$ process without infringing on the I. G. $K_2S$ patents. Both processes involve recovery of activating agent and after passage through one activation the KCNS is converted to $K_2S$, after which the processes were reputed to be identical. In order to clarify the patent set-up the KCNS patents were stated to have been purchased by I. G.

The reasons for the superiority of $K_2S$ and KCNS activated charcoals over $ZnCl_2$ activated material have been studied. According to the Leverkusen personnel, it is believed that $ZnCl_2$ activation imparts a hydrophilic surface complex to carbon which is partially converted to a hydrophobic complex by calcining or steam activation, whereas sulphur-containing activating agents are thought to yield a hydrophobic type of surface directly. The superior adsorptive properties at low partial pressures of gas are attributed to a smaller-diameter pore structure with the sulphur-containing activating processes.

## SUPERIOR PRODUCT

The $K_2S$ and KCNS processes were used primarily for producing respirator charcoal, and perhaps some solvent recovery carbon. For normal solvent recovery purposes $ZnCl_2$ charcoal is considered superior because of greater capacity at high relative pressures of solvent. Because of high cost as compared with other processes, and because the pores are considered too small for the adsorption of other than gas molecules, neither $K_2S$ or KCNS activations were used for the manu-

facture of decolorizing carbons. For producing respirator carbon, the process is similar to that with $ZnCl_2$. About 0.4 parts $K_2S$ or KCNS and 0.4 part of KOH in the form of saturated solutions are used per part of peat or charcoal, and the materials mixed in a manner similar to that in $ZnCl_2$ activation. The mixture is either then directly extruded or else first partially dried at 110 deg. C. and bound with tar. The extruded product is then calcined in indirect heated, brick lined, rotary kilns. Since the material is readily ignited, the heating is very carefully controlled at temperatures just below the ignition point. The product is washed, dried, and treated with the usual impregnants, using equipment similar to that with $ZnCl_2$. No secondary activation is necessary.

## STEAM ACTIVATION

Information on the steam activation process was obtained by inspection and by interviews at the Deutches Gold-und-Silber Scheideanstalt plant, Brilonwald, Brilon. Steam activation of beechwood charcoal was operated by this company in two plants in the vicinity of Brilon. The company was engaged principally in the destructive distillation of wood for the production of gas-generating and fuel charcoal, tar, methanol, and adsorptive carbons.

### RESPIRATOR AND SOLVENT RECOVERY

The base material used for the manufacture of respirator charcoal and solvent recovery carbon was the charcoal obtained from beechwood by destructive distillation at about 450 deg. C. Peat could be used but beechwood charcoal was found to process better and yield a superior adsorptive product. Care is taken to use charcoal of low volatile content for activated charcoal for respirators; for solvent recovery carbons the volatile content of the base charcoal was considered of less importance.

Charcoal is first ground in a ball or hammer mill to pass a German 80 mesh sieve. Ground charcoal is mixed with tar in Werner and Pfleiderer type mixers. Mixing takes place in batches, using 120 kg. charcoal and 95 kg. tar per batch. The tar used, obtained from the beechwood distillation, contains 20 to 30 percent fixed carbon and is of 20 to 30 deg. Engler viscosity at 60 deg. C. Other tars could be used provided suitable adjustments were made in the plant procedure. The mixers are unheated but were maintained at a temperature of 50 to 60 deg. C. by preheating the tar to 75 deg. C. and by not permitting the equipment to cool between batches. In addition to charcoal and tar, the following materials are added to each batch: 4 l. of 45 percent KOH solution; 80 g. of powdered CuO (for respirator charcoal only); 5 l. of 19 deg. Be CuSO, solution (for respirator charcoal only). KOH is used as an activating catalyst. Copper compounds are added to increase the adsorptive quality of the respirator charcoal for hydrocyanic acid gas.

Each batch is mixed for about 20 min., the mixer dumped, and the contents carried in small carts to the extruder presses. These presses are of a specially designed "spaghetti" type, operating at 220 atm. pressure. Originally the orifice plates were made of steel but, because of excessive wear, had been replaced with more durable porcelain orifice-inserts. For solvent recovery purposes a 4.5 mm. diameter extrusion is used; for respirator charcoal a 1.5 to 1.6 mm. diameter extrusion was in use and was about to be reduced to 1.0 mm. at the close of the war. No crushing equipment is used, the extruded strands apparently being reduced to about 2 mm. lengths by passage through the carbonizer and activator.

Extruded strands are carbonized in rotary kilns at 350 to 400 deg. C. The kilns are of iron, 10 m. long by 1 m. diameter, lined with firebrick. They are direct heated, using a portion of the exhaust gases from the activators for this purpose, with the remainder of these exhaust gases used for preparing steam for the activators.

The carbonizing step serves to harden and devolatilize the granules, after which they are blown by an air elevator into the activators. Activation is conducted in horizontal rotary iron kilns 13 to 16 m. long by 1.4 m. diameter, lined with fire-resistant brick. The kilns are direct gas fired. Steam for activating, gas, and carbon granules enter the kiln at the same end, with the inlet temperature maintained at 900 deg. C. and the exit temperature at 500 to 600 deg. C. Steam consumption is 80 to 150 kg. per hour for a production rate of about 1 metric ton of activated charcoal per 24 hour day. The charcoal from the kiln drops directly into a vertical pipe filled with water, to prevent ignition from contact with air, and is then fed to a Dorr-type multideck classifier for washing.

Activated charcoal direct from the kilns contains 8 to 9 percent $K_2CO_3$ and is washed with water until the $K_2CO_3$ content is reduced to 2 to 3 percent for respirator purposes, and to less than 0.5 percent for solvent recovery purposes. The granules from the classifier are dried at 140 deg. C. in a horizontal rotary dryer 6 m. long by 1 m. diameter. Carbon for solvent recovery use was screened and packed. Respirator charcoal was first passed into a revolving, wooden drum where it was sprayed with aqueous solutions of the previously mentioned impregnants. Over-all yields of activated product on a beechwood charcoal basis were claimed to be from 50 to 55 percent. The apparent density of the product ranged from 0.35 to 0.40.

Raw material for decolorizing carbon is beechwood charcoal, 2 to 8 mm. diameter, obtained by pre-screening the charcoal used for other types of activated charcoal production. The granules are fed into a small, direct gas fired, brick lined, horizontal, rotary furnace, 1.25 m. long by 1 m. diameter. From 120 to 160 kg. are activated per batch, at a temperature of 920 to 950 deg. C., using about 70 kg. of steam per hour. The charge is activated from 1 to 4 hours depending on the quality desired, then cooled and ground, usually to pass a German 80 mesh sieve.

### ELEMENTAL CARBON

"Elemental carbon" is the designation used in Germany for the material used in forming carbon electrodes for dry-cell batteries, etc. This material was made at Brilonwald from peat coke, using up to 2 mm. diameter size particles, by calcination at 1000 deg. C. for 18 hours in the presence of a small amount of steam (at most 5 kg. per hour per 100 kilo-batch). The charge was then cooled and ground to 0.1 to 0.5 mm., then sold to the electrode manufacturers.

## HEAT PUMP

(*Continued from page 100*)

ture heat is sought, a heat pump with an actual COP of 6, which is not unusual in industrial applications, would give an operating cost of 4.8 cents per million B.t.u. This is an exceptionally low price for heat and makes it possible to justify additional investment charges for a heat pump installation over a direct heating arrangement. It is apparent that when actual cost of raw fuel is in the neighborhood of 25 to 30 cents per million B.t.u., there are many applications where heat pumps may be justified even with electric energy costing as high as 5 to 6 mills per kw. hr.

In conclusion: (1) The authors do not believe that the heat pump can be universally applied to the solution of all industrial heating problems. However, (2) It has been shown that numerous industrial heat applications can benefit from the use of the heat pump in lieu of direct thermal processes. The analysis presented here, plus experience accumulated thus far, warrants the conclusion that further investigation, developments and applications of the heat pump in the industrial heating and cooling field can be made with advantage to obtain an improved and more economical operating cycle.

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# CHEM. & MET. PLANT NOTEBOOK

THEODORE R. OLIVE, Associate Editor

## $50 CASH PRIZE FOR A GOOD IDEA!

Until further notice the editors of *Chem. & Met.* will award $50 cash each month to the author of the best short article received that month and accepted for publication in the "*Chem. & Met. Plant Notebook.*" The winner each month will be announced in the issue of the next month: e.g., the June winner will be announced in July, and his article published in August. Judges will be the editors of *Chem. & Met.* Non-winning articles submitted for this contest will be published if acceptable, in that case being paid for at space rates applying to this department. (Right is reserved, however, to make no award in months when no article received is of award status.)

Any reader of *Chem. & Met.*, other than a McGraw-Hill employee, may submit as many entries for this contest as he wishes. Acceptable material must be previously unpublished and should be short, preferably not over 300 words, but illustrated if possible. Neither finished drawings nor polished writing are necessary, since only appropriateness, novelty and usefulness of the ideas presented are criteria of the judging.

Articles may deal with any sort of plant or production "kink" or shortcut that will be of interest to chemical engineers in the process industries. In addition, novel means of presenting useful data, as well as new cost-cutting ideas, are acceptable. Address entries to Plant Notebook Editor, *Chem. & Met.*, 330 West 42nd St., New York 18, N. Y.

**MAY WINNER!**

**A prize of $50 in cash will be issued to**

**J. J. KRAUKLIS**
Chemical Engineer
Chicago 19, Ill.

**For an article dealing with a convenient arrangement for manifolding service lines to process vessels that has been judged the winner of our May contest.**

**This article will appear in our July issue. Watch for it!**

**April Contest Prize Winner**

## SULPHURIC ACID EQUILIBRIUM CELL DETERMINES AIR MOISTURE CONTENT CONTINUOUSLY

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A COMMONLY USED method of determining moisture in gases is by passing a measured amout of gas through a tube containing a drying agent and then weighing the tube, but the scheme is cumbersome and time-consuming. In some cases other methods such as the dewpoint, wet-bulb, thermal-conductivity, and hair-hygrometer methods may also be used[a]. A new and simple continuous method is described here.

If moisture-laden gas is passed through a sulphuric acid solution the moisture in the gas and the moisture above the solution will come to equilibrium. For example, if the gas contains more moisture than the vapor above the sulphuric acid solution, the solution will be diluted until equilibrium is reached. The time necessary to reach equilibrium will depend upon the temperature and the rate of flow of the entering gas and the initial concentration and quantity of sulphuric acid. The time required to attain equilibrium, therefore, should be determined in actual operation under the conditions of the test, since it will vary for each set-up. After equilbrium is reached, the moisture in the entering gas can be calculated from the strength of the sulphuric acid solution, the temperature of the solution and the equilibrium partial pressure data of water over sulphuric acid-water mixtures. It is not necessary to measure the gas flow rate.

In Fig. 1 a diagrammatic sketch of the apparatus is shown. A 1-in. diameter test tube containing a 2-in. depth of glass beads is fitted with a three-hole cork stopper. Sulphuric acid is added to a 2½-in. depth (about 25 cc.). Through one hole in the stopper a glass tube is placed, extending to as close to the bottom as possible. This is for the entering gas. The gas leaves through a small piece of glass tubing placed in the other hole. A thermometer is inserted in the third hole to measure solution temperature.

A chart showing the vapor pressure of water over sulphuric acid solution at various temperatures appears in Fig. 2. The curves were compiled from data in Landolt Börn-

**Fig. 1—Equilibrium cell made from test tube, glass beads, thermometer and sulphuric acid**

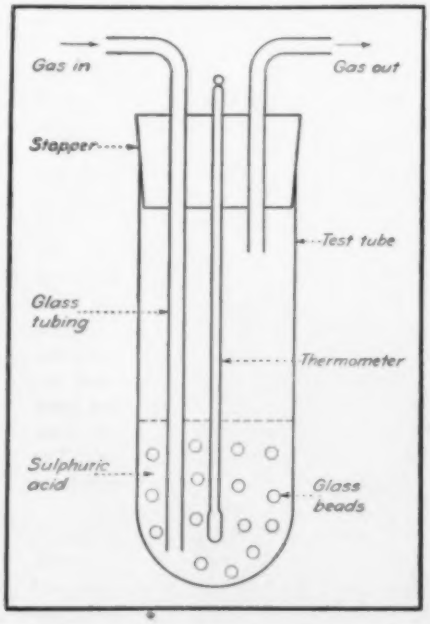
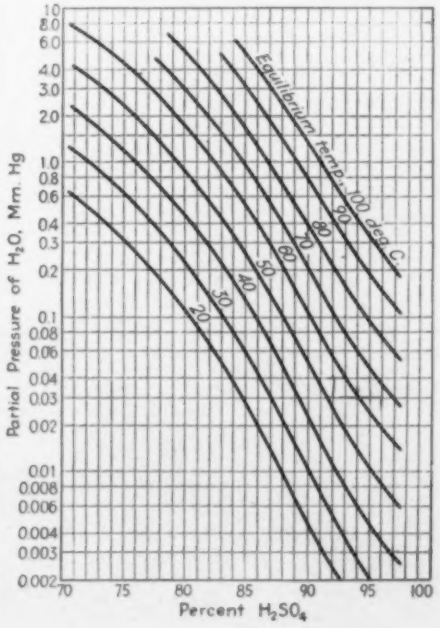



**Fig. 2—These curves show relations between temperature, acid concentration and water partial pressure**



stein[1] and International Critical Tables[2]. Use of this chart is given in the illustrative example below.

The procedure used in making a moisture determiniation by the proposed method is as follows. The gas to be determined is run through the sulphuric acid as shown in Fig. 1. The temperature of the sulphuric acid solution is recorded and the temperature of the gas is noted. When the temperature of the solution reaches a constant value, equilibrium conditions have been attained. This temperature should be approximately the same as the gas temperature. If the initial concentration of sulphuric acid used is near the equilibrium concentration constant conditions will be reached sooner. A method for estimating this concentration will be given in the illustrative example below. The constant value of the sulphuric acid solution temperature is recorded and the barometric pressure determined. Then a sample of the solution is removed from the test tube (about 5 cc.) for titration and the test tube replaced. The acid concentration may be determined by any one of the standard industrial titration methods. Where the concentration range is known and the change in concentration not too large, conductivity measurements may be employed, eliminating the necessity of removing a sample for titration. After the titration 5 cc. of approximately the same strength acid (so as not to disturb equilibrium conditions) is added to the test tube as make-up.

If, for example, in a test on a gas by this method, it is found that the barometric pressure is 753 mm. Hg; the sulphuric acid temperature is 40 deg. C.; and the sulphuric acid concentration at time of sampling is 85.0 percent then, from Fig. 2, the partial pressure of water is found to be 0.12 mm. Hg. Hence, V = volume fraction = (partial pressure of water)/(barometric pressure) = 0.12/753 or V = 0.00016 cu. ft. water per cu. ft. of gas. To convert to milligrams of water per cu. ft. of gas, multiply by $6.21 \times 10^6/(273 + t)$, where $t$ is in degrees C. Then $0.00016 \times 6.21 \times 10^6/(273 + 40) = 3.17$ mg. water per cu. ft. of gas.

The initial concentration of sulphuric acid to use can be estimated, if the moisture in the gas is approximately known, by working the above example in reverse. For example, if the moisture is known to be about 5 mg. per cu. ft., the temperature of the gas 40 deg. C., and the barometric pressure 753 mm. Hg, then $5.0 \div [6.21 \times 10^6/(273 + 40)] = 0.000252$ cu. ft. water per cu. ft. gas and the partial pressure of water = $0.000252 \times 753 = 0.19$ mm. Hg. Then from Fig. 2 the concentration of sulphuric acid at this partial pressure and a temperature of 40 deg. C. is found to be 83.5 per cent. If this strength acid had been used to start the test illustrated above, the concentration would have to change from 83.5 to 85.0 percent to reach equilibrium.

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## PRESSURE DROP CHART FOR SULPHUR FLOW


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SINCE molten sulphur is often pumped today (as in sulphur burning in sulphuric acid plants) in lieu of methods of handling the sulphur in solid condition, it is valuable to have data in convenient form on the pressure drop of molten sulphur pumped through pipes of various diameters.

The accompanying chart is calculated from the Fanning equation, with the flow friction factors taken from the 3rd edition of Walker, Lewis, McAdams & Gilliland, "Principles of Chemical Engineering." The viscosity of sulphur is taken at an average of 8 centipoises for the temperature range of 250-300 deg. F. In this range the viscosity of pure sulphur has been found to vary between 10 and 6. Since data are unavailable for the viscosity of mine-run sulphur, a value of 8 is suitable and will not introduce errors larger than those already present in the Fanning equation. Sulphur density is taken at 112.5 lb. per cu. ft.

## SUMP PREVENT BLOCKING DRAINAGE SYSTEM


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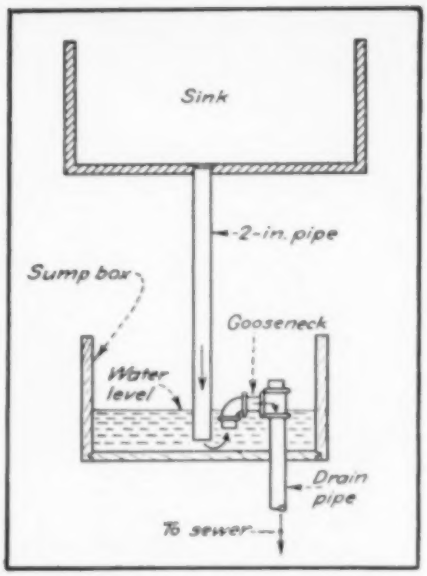
IN LABORATORIES or plants where liquids containing solids go to the drainage system, trouble is often encountered with the sludge depositing and clogging the pipes. This is especially true when materials such as latex are dumped into the sink.

To alleviate this trouble with little expense, a set-up as shown in Fig. 1 was utilized with success. The sink drains into a water-tight wooden sump box through a 2-in. pipe whose open end is 2 in. from the bottom of the box. A "gooseneck" made of 2-in. pipe is set in the box with the open end about 4 in. from the bottom. The open end of the tee at the upper end of the drain pipe acts as an air vent and also as an overflow in case the inlet at the bottom should become plugged. The "gooseneck" is set in the box so that the liquid level is 6 in.

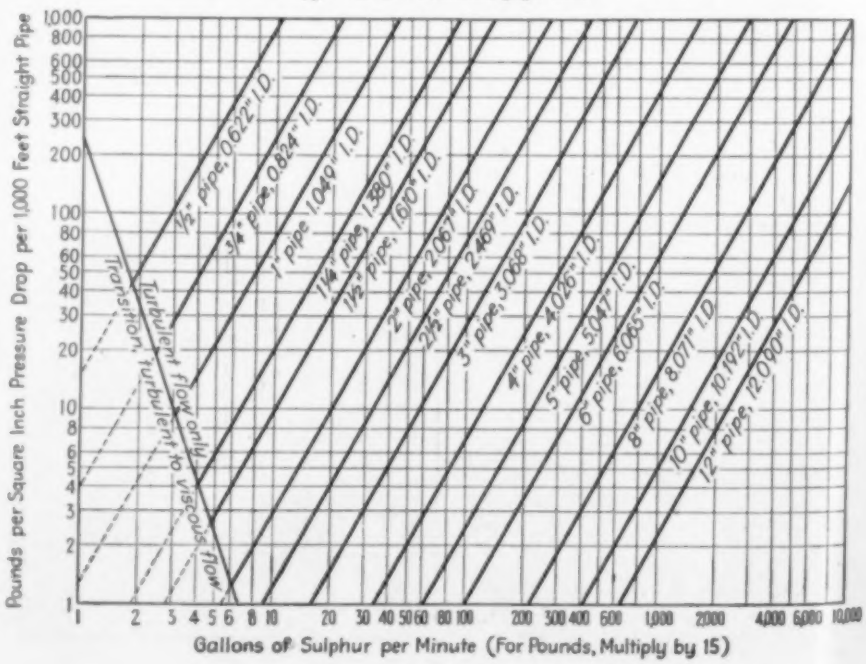



**Sump below sink prevents solids from entering drainage system**

When suspended particles enter the box, those with a specific gravity greater than the liquid will deposit on the floor of the box, and those with less will float at the liquid level. This permits the clarified effluent to pass to the sewer line through the "gooseneck." Periodically sludge is removed.

When latex is being discarded it is advantageous to add a coagulant such as acetic acid to the sump. This will coagulate the latex there instead of allowing it to deposit in the pipe lines.

**Chart gives pressure drop in pumping molten sulphur through standard iron pipe from ½ to 12 in. nominal pipe size**



## SAVINGS IN SHIPMENT WITH ALUMINUM PALLETS

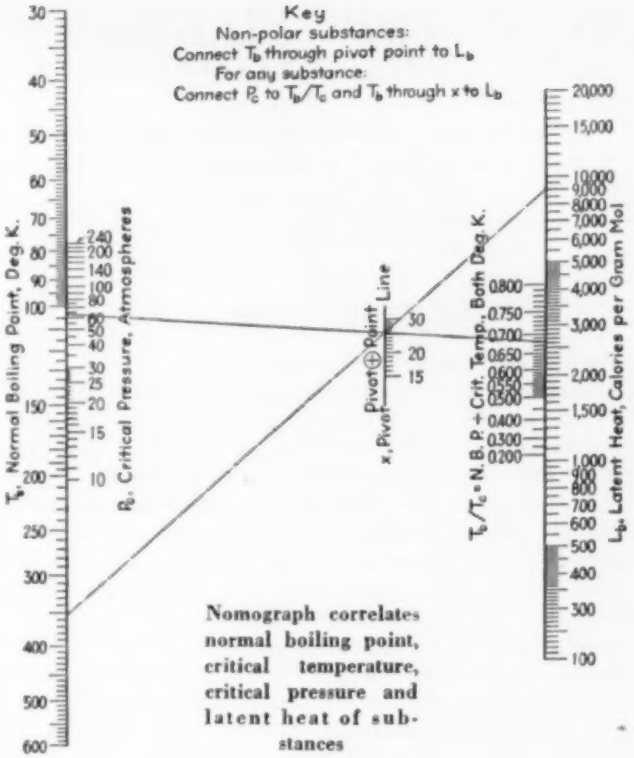
IN OUR ISSUE of November 1945 a 12-page report gave detailed information on the advantages of handling materials on skids and pallets, and on the trend during the war years particularly toward the second of these handling methods.

The Materials Handling Division of Reynolds Metals Co., Louisville, Ky., now offers data on the savings that are possible with a design of aluminum pallet that is sponsored by Reynolds. It is pointed out that at the present time all pallets take the same freight rate as the goods they carry and that, for example, in shipping a carload of 36 pallets of canned goods from New York to Chicago the freight on the pallets one way would be $18.50, while the charge on the same pallets would be $51 if they carried clothing. Hence palletizing of light-weight goods that take a high freight rate involves an almost prohibitive shipping charge if heavy pallets are used.

Reynolds' standardized 40x48 in. aluminum pallets weigh 36 lb. apiece, compared with about 100 lb. for pallets of most other materials of the same size. Hence the use of aluminum results in a saving of about 64 lb. per pallet. In shipping certain palletized goods from Louisville to Detroit (about 400 miles) the freight cost runs 1c. per lb., meaning a saving of 64c. per pallet on the outgoing shipment alone. Return shipment of standard pallets of this size would be at the rate of 0.36c. per 100 lb. Since a standard box car will carry 540 pallets, such a car containing wood pallets would have a load of 54,000 lb. A car loaded with aluminum pallets, however, would be carrying only 19,400 lb. Since the minimum carload rate of 30,000 lb. would apply, shipping cost for aluminum would be $108 per car, compared with $194.40 for wood. There is thus a saving of 16c. per pallet on the return shipment. For the round trip the saving in favor of aluminum is 0.80c.

Assuming 13 round trips per pallet per year, the saving would amount to $10.40 per year. If an aluminum pallet costs $26 compared with $3.50 for a wood unit, a difference of $22.50, it would require a little over two years for an aluminum pallet to pay for itself. Its yearly return would be roughly 45 percent of the added investment. Assuming a conservative life of 20 years, the saving in 20 years, over and above the added investment, would amount to $185.50 per pallet.

It is further pointed out that still further savings are possible since aluminum pallets are claimed to need no servicing. Other advantages include the facts that they are non-sparking and non-combustible and that they are designed for eight-way entry of the truck forks to facilitate maneuvering in tight areas. Made of high strength alloys they are said to have supported test loads up to 26,000 lb. without damage.




**Nomograph correlates normal boiling point, critical temperature, critical pressure and latent heat of substances**

## NOMOGRAPH GIVES LATENT HEAT OF SUBSTANCES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SEVERAL fundamental properties for any substance may be correlated by the equation:

$$L_b/T_b = \frac{R \ln P_c(1 - 1/P_c)}{1 - T_b/T_c}$$

where $T_b$ = normal boiling point, deg. K.; $L_b$ = latent heat at $T_b$, cal. per gram mol; $R$ = gas constant = 1.987; $P_c$ = Critical pressure, atm.; and $T_c$ = Critical temperature, deg. K.

This equation[1] is a combination of the Nernst equation of state for a saturated vapor, the van der Waals vapor pressure equation, and the Clapeyron equation. A small group of compounds selected at random gave calculated latent heat values within 5 per cent of the experimental values.

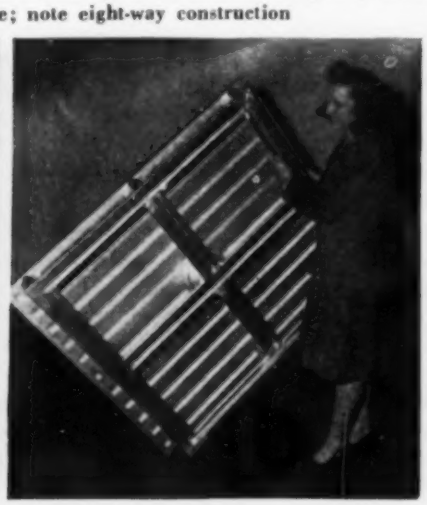
Use of the nomograph is shown for ethyl alcohol where: $T_b$ = 351.4 deg. K., $P_c$ = 63.1 atm., $T_c$ = 516.2 deg. K., and $T_b/T_c$ = 0.68. Connect $P_c$ to $T_b/T_c$. Connect $T_b$ through $x$ to $L_b$. Read $L_b$ = 9,000.

If $T_c$ is not known, Guldberg's approximation $T_b/T_c$ = 0.67, may be used. However better accuracy may be obtained by calculation of $T_c$ from $T_b$ by the Meissner and Redding equations for which nomographs[2] are available. If $P_c$ is not known it may be obtained by the methods of Gamson and Watson or Meissner and Redding.

As a first approximation in estimating latent heats from normal boiling points for any substance, Trouton's rule may be applied, taking a value of 21 on the center scale (pivot line x). The results are not too satisfactory, especially for gases having low critical pressures, and the higher boiling liquids having high critical pressures.

For non-polar compounds the latent heat may be obtained from the normal boiling point alone by means of the Kistiakowsky equation: $L_b = T_b\,(8.75 + 4.571 \log_{10} T_b)$. This relationship is obtained on the nomograph through the use of the pivot point.

**Aluminum pallets cut the weight of each pallet load by about 64 lb. Young lady finds aluminum pallet easy to handle; note eight-way construction**



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2. "Plant Notebook," *Chem. & Met.*, May 1946, p. 147.


*Correction*—In the nomograph on partial pressure of HCl on page 117 of our April issue, the right hand scale should be labeled "Weight Percent of HCl."

# FROM THE VIEWPOINT OF THE EDITORS——



## ANNUAL WAGE GUARANTEES

An important factor in wage contracts is soon going to be the question of guaranteed minimum annual take-home wages for workers. When that factor becomes an immediate problem of the process industries we shall have new and greater incentive for the stabilization of production.

It is fortunate that a majority of chemical process industries are not highly seasonal in their operation practice. Some which are seasonal by habit, are not intrinsically seasonal of necessity. Only a very few must function on a limited season basis. Thus much of the chemical engineer's problem will be to stabilize production with reasonable product storage whenever he finds that net costs are lowest only when almost uniform year-round operation is had.

In many other cases one of the greatest problems of process industry will be to get customers to take their annual needs of products on a more uniform year-round basis.

Fortunately most of us are not yet confronted with this problem as an acute one. But that is no reason for ignoring it. If steps are taken now to stabilize production and sales as near as possible to the average level, then we shall be working toward the condition at which we must actually govern most of our operation in the not distant future. And certainly it is not too soon to urge customers to eliminate needless seasonal factors in their buying to the maximum extent. Perhaps we shall even find it worthwhile to offer price inducements to change some of the less regular buyers into the preferred class which takes our output uniformly the year round.

## MORE PRIVATE STANDARDIZATION

As a result of conferences among industry leaders, and between these groups and the Secretary of Commerce, private initiative has been given the green light and told to take over the formulation of voluntary standards, both for industrial and for consumer products. The vehicle for this work is the 28-year-old American Standards Association, and the significance of the decision is that more of the work of standardization is to be intrusted to interested private parties, while less of it than in the recent past will be developed under the aegis of the Department of Commerce.

To those who have been crying for less government in business, this withdrawal on the part of a Secretary who has quite consistently given evidence of wanting more governmental control should be both a signal to proceed, and a challenge to support. Admittedly, the ASA is not at present either set up, or adequately financed, to assume the bulk of the burden. Steps are being taken, however, to alter the situation, but these can be successful only if companies, trade and technical associations will throw their weight and their pocketbooks behind the effort.

## NO PORK BARREL FOR SCIENCE

Political Washington seems to have been losing interest in the proposed National Science Foundation to a considerable degree for two reasons. First, the atomic bomb problems and control projects gained much greater public interest and, therefore, political glamor. Second, there seemed to be suspicious evidence of an organized campaign in support of the foundation by some rather selfish groups that expected to profit from federal aid for fundamental rereasch.

The importance of fundamental research has not declined. It is unfortunate, therefore, that some of the over-zealous supporters have given this "pork barrel" significance to the undertaking in the minds of many congressmen. It is not likely that there were very many important groups who actually had so selfish a motive. But the very appearance of that motive did as much damage as any wrong purpose.

It is now time for those who believe in fundamental investigations by government under civilian control for national defense and for public health purposes to reemphasize these needs on a more dignified professional plane. It will be fortunate also if the more vociferous groups seeking aid for tax-supported institutions be less clamorous for their selfish ends.

## CHEMURGIC PROGRESS NEEDED

In years of abundant crops the preparation for famine years is necessary. Less recognized, but no less important socially, is the need for planning to use surpluses even while scarcity still prevails. The present huge effort of farmers to produce a maximum of crops is going to create a surplus problem, possibly in the early fifties. Our excesses in supply of corn, wheat, cotton, and some other major farms products are likely to be even greater than those which Franklin Roosevelt and Henry Wallace tried to handle with a managed agriculture.

Permanent solution of such problems can come only by devising new uses through processing surplus grain into non-food products. That is chemurgy at its best. Such a program is easily stated but difficult of accomplishment. Much research as a basis for planning is needed immediately.

If industry does not do this planning and make aggressive effort to industrialize the products of agriculture one may expect that Congress sooner or later will ask the government to do so. Putting the government thus into business for the benefit of agriculture has not lost fashion in the Capital City. Even this May a large group of Senators received with enthusiasm some suggestions from the planners in the Department of Agriculture which would put Uncle Sam very deep into this business. The only sure and safe offset for such legislation as S. 1908 is evidence that industry is doing the job and that government does not have to do it.

## RUBBER FUTURE PLANNED

No single policy question is more important to the American people in international affairs than the future of synthetic rubber. Failure to appreciate that fact and to make adequate arrangement for the protection of synthetic rubber could easily again put the United States in a position of complete dependence on natural rubber imports. That would be an intolerable situation; but it is not unthinkable that such may be the result if proper official programs are not put into effect.

Most important in immediate prospect appears to be the need for establishing a sound basis on which present American synthetic rubber plants may be continued in operation or in operable condition on a very large scale. The Inter-Agency Committee on rubber policy (Batt Committee) has made two important and effective recommendations to this end. It proposes that indefinitely there shall be operated in the United States at least 250,000 tons per year of synthetic all-purpose-rubber capacity, and that 350,000 tons of additional capacity be always maintained in standby condition with facilities and personnel ready to put it to work on short notice. It is to be hoped that such combination will provide indefinitely for 600,000 tons per year.

But chemical engineers know that such a program means little or nothing unless certain technologic factors are taken into account adequately. Three of these factors are so important, and get so little appreciation, that they deserve frequent repetition.

(1) No plan provides adequately for standby condition of a property that does not continuously provide an adequate technical management and staff immediately available, including a substantial number of key persons capable of directing new employees in the proper functioning of the plant if suddenly enlarged in activity.

(2) Mere operation or readiness to serve is not enough unless the operation when attempted will be on the latest and best technical basis with assurance of a product of the finest quality that science and engineering knows how to produce at any particular time. Obsolete equipment and methods, even obsolescence at its early stages, must be constantly eliminated or "readiness to serve" is a deceptive fiction, not a reality.

(3) Aggressive commercial management, not perfunctory government operation, is essential to coordinate the synthetic plants with the needs and the practices of the rubber-using industry. And since such operation is going to be inevitably at some loss, because of readiness to serve factors, there must often be a subsidy from the government to the firms as an offset to the extra cost when much of the capacity is maintained idle.

Fortunately Washington still talks about acomplishing permanent rubber preparedness through the efforts of private enterprise. It is sincerely to be hoped that such practice will follow. But the technical principles just enunciated must be recognized and the American taxpayer must be ready to bear some of the indirect burdens of commercial effort for a number of years to come. This might not be true if the natural rubber industry were solely private business. But it is not. The British and Dutch Governments own too much and dominate too fully to make it feasible for purely private U. S. companies to be successful competitors, especially in an America of very high wage rates.

It is evident that not all of the economic or political problems have yet been solved. They may prove to be even more difficult of solution than the technological ones with which chemical engineers are best acquainted. But they must be faced frankly, and soon.

## RECOGNITION AND REWARD

There is much to commend in the recent program of the Du Pont company for its recognition of some of its promising research scientists. These men are being given special recognition as senior research associates with salary increases that are quite comparable with those of responsible management and administrative officials of the same company. This means that they get deserved reward and recognition without the necessity of diverting their energies from the fields in which they have demonstrated great capacity for service and value to their employer. It means also that an outstanding research man does not have to be made into an administrative executive simply to give him a somewhat better salary.

One wishes that there were more companies and institutions that could see this need. Nothing is more unfortunate for our profession—and the public—than to have brilliant researchers wasting their time as mediocre administrators.

## TAKE OFF THE BRAKE

More goods at lower prices is not an empty slogan in most chemical industries. It is a working philosophy that has come to characterize our progress. Even during the stress of war production there were many chemical companies that consistently reduced their prices as improvements in volume and technology lowered their costs. Today, for the first time in almost two decades, these plants find their costs rising to the extent that profit margins are narrowing to the point of disappearance. Yet the industry as a whole has not been clamoring to OPA for price relief.

Much of our progress toward lower and lower costs has been due to the contributions of the equipment manufacturers whose engineers work closely with their customers in improving processes and developing more efficient machinery. Today these industries are also beginning to feel the pinch. Costs of certain of their components, such as gray iron and alloy steel castings and forgings, have advanced considerably yet the process equipment manufacturer must continue to operate under an Oct. 1, 1941, price ceiling that does not permit him to pass these increased costs on to his customers. As a result there has been a natural tendency to turn to more lucrative fields, meanwhile neglecting the urgent needs of the chemical companies that must bring down their costs and get their new product developments.

The greatest possible contribution to all concerned will come when it is possible for OPA to suspend all price controls over process equipment, just as it has already done for machine tools and other machinery industries. Such price increases as might result from a blanket suspension of price control would certainly not have any inflationary effect on the cost of living. Process equipment is used primarily in producing other than consumer goods where its job is to lower rather than increase the costs of production. Chemical manufacturers now need that service more than ever before. Take off the brake and we will all go ahead!

REPORT ON.....

# MEXICO'S


**Mexico's chemical industry is located principally in the Federal District and in the States of Jalisco, Nueva Leon, and Coahuila, and to lesser extent in the States of Mexico, Guanajuato, Michoacan, Nayrit, Puebla, Tamaulipas, Veracruz, Chihuahua and Yucatan**

Mexico is experiencing an industrial boom that got underway in the late 1930's and has gained momentum each year. The 1945 industrial census shows a phenomenal growth in industry since 1940. The number of enterprises has increased from 13,513 to 28,513. There are more new automobiles, more new homes, office buildings and construction of all kinds than are to be found in the entire United States. And plans are on the drawing boards for extensive hydroelectric power development, irrigation projects, highways throughout the Republic, flood control works, additional school buildings, hospitals and other public edifiices. One of the important semi-public projects is "University City" to house the National University of Mexico, one of the oldest schools of higher education on the American continent (founded 1551), which now holds its classes in several buildings scattered throughout the capital city.

This expansion was encouraged by more stable political and financial conditions in the country, by the broader distribution of wealth, and by a new influx of foreign capital. The devaluation of the peso gave an important initial stimulus to domestic industry. The liberation of credit, a succession of good crop years and promotive measures gave further impetus.

The chemical process industries are taking part in the "evolution" as President Mañuel Avila Camacho has called this period of great industrial progress in Mexico. Although the chemical industry has been relatively small, accounting for less than 10 percent of the total manufacturing output of the country, and is loosely integrated, recent developments have expanded it considerably. Before the War Mexico produced only 3 percent of the industrial chemical products it needed, today it makes more than 10 percent.

Sosa Texcoco, S. A., a million dollar organization financed by Sociedad Mexicana de Credito Industrial, S. A., and private Mexican capital, has under construction a plant 15 miles from Mexico City. It is projected in belief that the remaining waters and dry bed of Lake Texcoco, drained many years ago, is a rich source of soda ash, caustic, salt, and potassium salts. An interesting feature is the 2,000-acre solar evaporator built like a snail shell. The Chemical Construction Corp. is supplying the technical advice for the plant.

Celanese Corp. of America has under construction two plants which will cost approximately 35 million pesos. The Viscosa Mexicana, S. A., has recently acquired a plant site at Zacapu on which will be built a viscose plant. And Celanese Mexicana, S. A., now has under construction an acetate plant at Ocotlan, about 50 miles from Guadalajara, Mexico's second largest city. The output of the two plants will be about 12 million pounds. A short time ago Celanese acquired a smaller plant at San Angel, a suburb of Mexico City which will operate when modifications are completed as Artisela Mexicana, S. A., and produce vis-

# CHEMICAL INDUSTRY

**To the south of us is a country whose chemical industry has been making spectacular strides during the war, both in the number of new plants and products, and in its trade with the United States. In order to get at first hand a picture of the situation in Mexico, James A. Lee, managing editor of *Chem. & Met.*, flew to that country in March of this year. He made headquarters in Mexico City and visited industrial chemical areas in several sections of the country. While there Lee met and discussed the problems of the industry with many of its leaders, in education, manufacturing, both Mexican and American, consulting, and jobbing of American chemicals, as well as government officials. He visited chemical plants, old and new, large and small, Mexican and American. The accompanying text and data tell the story of the progress of our neighbors across the Rio Grande and what it means to the American chemical industry.**

cose staple fiber and continuous filament.

A new oil refinery will be built at Salamanca, State of Guanajuato, by Petroleos Mexicans ("Pemex," government oil monopoly) and the company also will construct a pipeline from Poza Rica, Veracruz, to Salamanca, the total cost of the project being reported at more than $7,000,000. The refinery will be a light oil plant and will have a capacity of 30,000 bbl. daily of enriched crude from the upper Veracruz and lower Tamaulipas oil fields. Production will consist of standard gasoline (about 65 octane), kerosene, diesel fuel, gas oil, fuel oil, and liquified bottled gas.

Petroleos Mexicanos is completing a refinery at Atzcapotzalco, a suburb of Mexico City. It will have a daily capacity of 40,000 bbl. and will produce 1,000 bbl. of 100-octane gasoline per day and 5,000 bbl. of 60-70 octane. Philips Petroleum Corp. is furnishing the know-how for this HF alkylation unit.

Guanos y Fertilizante de Mexico, S. A., has under construction a contact sulphuric acid plant at San Luis Potosi in the state of the same name. It will have a capacity of 50 tons a day and is being built by Chemical Construction Corp. The company plans to add an ammonia plant of 50 tons capacity immediately and will produce ammonium sulphate for the fertilizer trade.

Hewitt Rubber Corp. of Buffalo and Fabrica de Artifactos de Hule Eureka, S. A., the largest manufacturer of mechanical rubber products in Mexico entered into a working agreement a short time ago. The former supplies equipment and technical know-how to increase the output of the Mexican company. In return, Hewitt acquires a preferred stock interest in Eureka and will resume annual service fees.

Reynolds Metals Co. (Reynolds International Mexicana) is erecting a plant at Tlalnepantla, a few miles from the capital. Aluminum ingot will be shipped from the U. S. and fabricated into a variety of products. Alumino Industrial de Mexico (Canadian interests) has a plant under construction near Mexico City which will convert Canadian aluminum pigs to powder, sheets and profiles.

Marquette Cement Manufacturing Co. and Universal Atlas Cement Co. have become interested in Mexican projects. The former is reported to be supplying designing, construction, technical and operating services for two plants. One will be the Atoyac plant near Orizaba in the State of Veracruz and the other in the State of Chihuahua. Atlas is interested in a cement mill at Irapuato between Mexico City and Guadalajara in State of Jolisco.

Johns Manville Corp. has recently organized a Mexican company, Asbestos de Mexico, S. A., to make asbestos products. E. R. Squibb & Son de Mexico, S. A., is said to have a penicillin plant about ready to operate and will shortly complete construction of a streptomycin plant. In addition a plant with capacity to cover the national demand for acetic acid, is under construction.

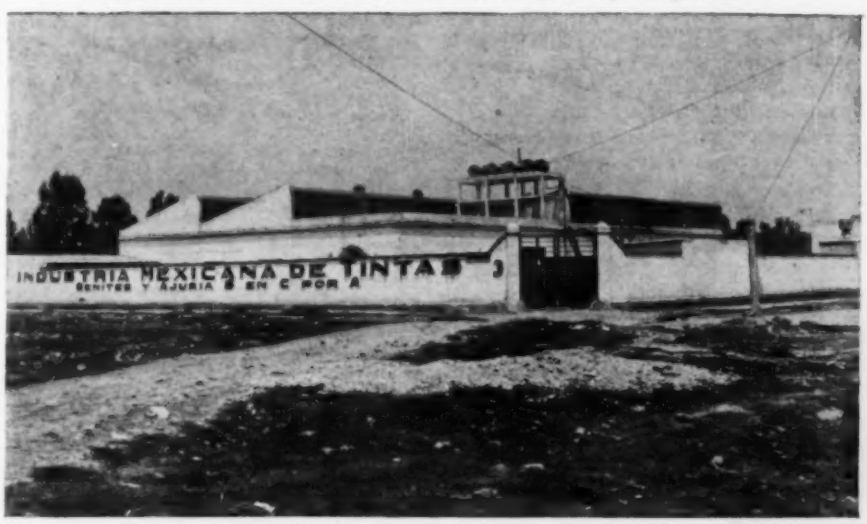
The number of industries in the consumers goods group is increasing. Relying to a large extent on imports of caustic soda and oils, but to no less degree on locally produced raw materials, a fairly large soap industry has been developed. The production of matches, candles, paints and varnishes, and printing inks, also is important although the quality of most of these products is rather low.

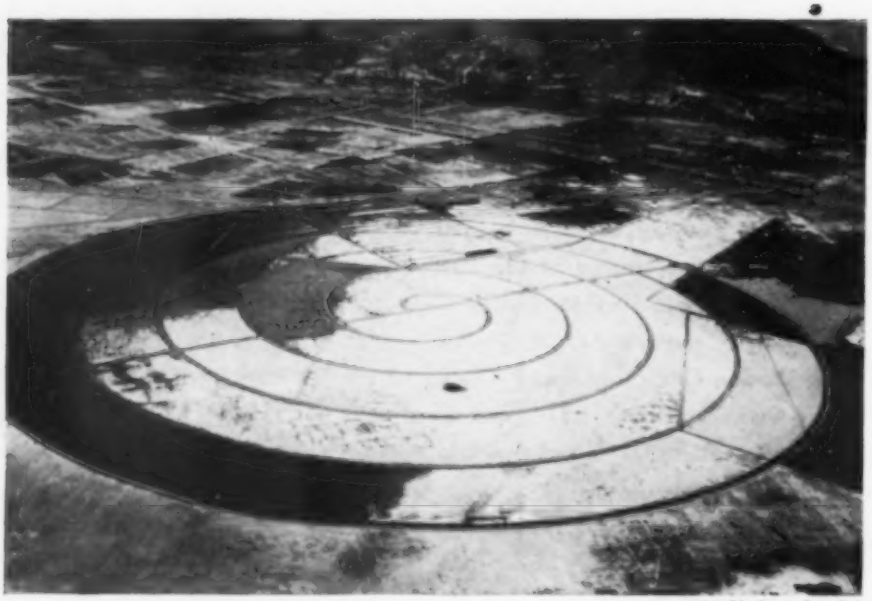
The principle of joint enterprise, advocated by the commissions of Inter-American Development of the 21 American Republics, is being carried out in the promotion of new industries in Mexico by United States and Mexican interests.

The commissions of Inter-American Development, affiliated with the Inter-American Commission, adopted a resolution in May 1944 recommending "that there be promoted, wherever possible, with just and equitable terms for both parties, the joint participation of foreign and domestic capital in the development of all types of enterprise."

It is difficult to determine to what extent American capital is participating in these chemical developments below the Rio Grande. However, it probably ranges all the way from 100 percent United States ownership down to none at all. In some cases, American companies have merely management or technical contracts, with or without

**Here is one of Mexico's black and colored printing ink producers**





*Cia. Mexicana Aerophoto*

**From this 2,000-acre solar evaporator Sosa Texcoco, S. A., will recover alkalis. The plant is a short distance from the evaporator**

financial or stock participation. In a few instances U. S. technicians have been employed in concerns entirely Mexican.

Reynolds International is said to have been organized in accordance with the mixed capital plan by the Banco Nacional de Mexico and the Reynolds Metals Co. of Richmond, Va. Celanese jointly American-Mexican, (Celanese, by special permission of the Mexican Government has 51 percent stock interest in the Mexican company), but Squibb, U. S. Rubber, Goodrich, Goodyear, Parke Davis, Abbott Laboratories, Johns Manville, U. S. Plywood and others have not been announced. It has been stated that there is no ban to the transfer of dividends and funds between Mexico and the U. S., and there is no indication of any limitation in sight.

In an effort to stimulate essential industries, Mexico inaugurated legislation in 1940. Major incentive provided is a five-year exemption from taxes. In the interval since this legislation became law about 400 new companies with initial capital of about $50,000,000 have registered and are utilizing the special benefits conferred. Since 1940, it is estimated that investment in all types of industries has amounted to about $90,000,000. Total capital invested in all manufacturing industries in Mexico prior to 1940 amounted to barely $780,000,000.

Summarizing progress under the act, the Bank of Mexico lists new essential industries in the first five years of the life of the act (with capitalization converted to dollars at the rate of 5 pesos to $1):

| *No. of Enterprises* | *Type* | *Capital (000 omitted)* |
|---|---|---|
| 71 | Foodstuffs and beverages | $1,624 |
| 55 | Metal products | 13,797 |
| 28 | Chemicals | 4,357 |
| 88 | Lumber, paper, ceramics | 3,880 |
| 43 | Miscellaneous | 12,669 |

The Mexican Government is encouraging the development of industries which are wisely conceived, particularly industries which will increase the self sufficiency of the country, and especially those which will convert Mexican raw materials into products that will be consumed within the Republic.

That part of the chemical industry in Mexico in which U. S. capital has no part operates in part under governmental and in part under private control and ownership. Governmental participation in the chemical industry was brought about by the exigencies of the second World War when the Mexican Government found it advisable to intervene, manage and operate the important pharmaceutical and chemical companies which were owned and directed by Axis, principally German, interests prior to the war. On June 13, 1942, Presidential decree brought the leading German, Italian and Japanese commerical establishments under Mexican control.

Before the recent war Germany unquestionably dominated the chemical market in Mexico. General de Anilinas, S. A., Carlos Stein y Cia., La Union Quimica, S. A., Casa Bayer, and Beick-Felix y Cia., and others had large and efficient distributing set-ups aided by corps of trained technical service men traveling in the field and bringing technical assistance of high caliber to clients in specialized fields.

By the beginning of 1943, however, a remarkable change had occurred. Germany was exporting nothing to Mexico and that country was looking to her neighbor north of the Rio Grande for her trade in chemicals. Her import figures represent almost entirely American goods and most of her exports of chemicals have been to the United States.

As might be expected from the geographical positions of the neighbors across the Rio Grande it is normal for this country to be Mexico's foremost market for its exports and source of supply for its import requirements. Before the second World War the ratio of this trade to Mexico's total was about 63 percent. The difference between this figure and the 85 percent for 1944 contributed substantially toward filling the gaps left by the cutting off of Europe in the early years of the war, as L. B. Clark of the U. S. Embassy in Mexico has stated.

In 1944 Mexican chemical imports reached somewhat over $26,000,000 which compares with $20,000,000 in 1941. The leading imports were coal tar dyes, synthetic rubber, copper sulphate, insecticides, sodium carbonate and bicarbonate, caustic and tannin extracts.

A reciprocal trade agreement between the two countries was signed on Dec. 23, 1942, and became effective on Jan. 30, 1943. The agreement granted duty reductions or bound the existing customs treatment on most of the principal articles of trade between the two countries, and provided for unconditional most-favored-nation treatment with respect to the internal taxation of

**IMPORTS OF CERTAIN ORGANIC CHEMICALS INTO MEXICO**

| Item | Kilograms | | |
|---|---|---|---|
| | 1939 | 1941 | 1943 |
| Acetanilide | 1,493 | 3,059 | 5,859 |
| Acetates: | | | |
| Benzyl | 982 | 1,498 | 5,541 |
| Butyl (other) | 10,451 | 6,146 | 3,452 |
| Ethyl | .... | 981 | 2,537 |
| Acetone | 73,254 | 138,563 | 33,592 |
| Acids: | | | |
| Acetic | 5,009 | 18,853 | 11,596 |
| Acetic (denatured) | 442,044 | 424,227 | 430,605 |
| Acetylsalicylic | 72,943 | 68,007 | 69,424 |
| Benzoic | 2,524 | 2,905 | 3,051 |
| Carbolic | 10,231 | 7,952 | 4,049 |
| Citric | 167,589 | 171,593 | 69,897 |
| Cresylic | 341,661 | 335,957 | 297,253 |
| Formic | 46,017 | 50,815 | 14,428 |
| Lactic | 22,437 | 56,996 | 46,194 |
| Oxalic | 33,032 | 12,001 | 62,662 |
| Phthalic | 14,193 | 7,734 | 5,244 |
| Salicylic | 7,266 | 7,868 | 9,516 |
| Tannic | 9,245 | 14,946 | 7,094 |
| Tartaric | 167,184 | 171,923 | 167,377 |
| Alcohols: | | | |
| Amyl | 114 | 173 | 2,047 |
| Butyl | 4,496 | 10,314 | 2,040 |
| Methyl | 8,240 | 16,690 | 37,552 |
| Alizarines | 56,315 | 35,491 | 23,105 |
| Aniline oil | 8,593 | 5,885 | 27,223 |
| Anthracene | 121 | 462 | 2,729 |
| Antipyrine | 3,606 | 4,414 | 2,265 |
| Benzo-naphthol | 1,310 | 4,271 | 1,638 |
| Carbon tetrachloride | 19,173 | 21,534 | 50,300 |
| Chloroform | 5,605 | 9,559 | 27,091 |
| Coal-tar dyes | 8,188,834 | 10,785,324 | 910,949 |
| Ether (ethyl) | 2,865 | 3,305 | 2,111 |
| Ethyl chloride | 3,895 | 32,821 | 86,579 |
| Formaldehyde | 101,099 | 25,994 | 86,226 |
| Glycols | 28,927 | 42,080 | 57,104 |
| Hexamethylene-tetramine | 5,340 | 4,696 | 7,290 |
| Hydroquinone | 4,188 | 3,381 | 1,061 |
| Menthol | 4,615 | 5,372 | 2,151 |
| Naphthol | 17,236 | 43,047 | 14,342 |
| Nitrobenzene | 7,214 | 8,451 | 5,781 |
| Phenacetin | 6,338 | 10,615 | 4,935 |
| Phenyl salicylate | 1,253 | 1,485 | 3,625 |
| Pyridine | 2,366 | 2,752 | 4,452 |
| Vanillin | 4,371 | 5,695 | 8,642 |

**Source: Foreign Commerce Weekly, Nov. 25, 1944, p. 7.**

imports. The duty concessions of the trade agreement are too numerous for presentation here, but an analysis of the general provisions, as well as of the duty concessions granted by each country, may be obtained from Bureau of Foreign and Domestic Commerce. As this is being written the reciprocal trade agreement between the two countries is being revised.

The Mexican Ministry of Finance, by the issuance of Administrative Circular 309-8-101, published in the Diario Oficial of Dec. 5, 1945, and effective therewith, has subjected 74 additional items in the Mexican import tariff to the requirements of import licensing. This circular was issued pursuant to powers granted to the Ministry of Executive Decree of April 14, 1944, published in the Diario Oficial of May 2, 1944. The list of chemical commodities which may be imported only upon the issuance of an import license by the Ministry of Finance is given elsewhere in this report.

There are some Mexicans who are convinced that their youthful chemical industry should have greater protection in the form of higher tariffs, etc., from the larger, more powerful U. S. competition. Lead by Engineer José Domingo Larrin, a leader of the National Chamber of Processing Industries, president of Productos Quimico de Mexico, S. A., and one of the most influential executives in the industry, the movement is making a strong bid for recognition.

Opposed to this movement are Mexicans who believe higher tariffs will result in greater inflation, lowering the quality of local products and other adverse effects on the industry.

The domestic chemical manufacturers produce alcohol, pharmaceuticals, fertilizers, insecticides, sulphuric acid, soaps, candles, printing inks, glues, paints and varnishes, vegetable oils and waxes, matches, naval stores, arsenic, mercury, explosives and many other products. The list has been growing in importance for some years. Most of the heavy chemicals are made by a few large concerns, but the output of pharmaceuticals, soaps and cosmetics come from a large number of small firms, ranging in size from one room establishments to several large well equipped plants.

The chemical industry is located chiefly in the Federal District and in the States of Jalisco, Nuevo Leon, and Coahuila, with smaller establishments in the States of Mexico, Guanajuato, Michoacan, Nayarit, Puebla, Tamaulipas, Veracruz, Chihuahua and Yucatan. The census of 1940 gave 410 firms producing chemicals which employed 9,137 workers. The capital investment of these leading establishments is 56,759,000 pesos, and the production value in 1939 was 129,113,000 pesos.

The country has a fairly wide variety of natural resources which provide the many raw materials for the chemical industry. The industrial census of 1940 shows that the value of domestic raw materials consumed by the leading chemical manufacturers was 53 percent of the value of all raw materials used by them. Natural gas is available in the States of Tamaulipas, Nuevo Leon and Coahuila, and is utilized to some extent in the oil regions of Tamaulipas, but most of the gas used as fuel is brought from Texas. Petroleum for fuel and as a raw material is found in abundance. Coal is produced in the State of Coahuila and deposits have been reported in the States of Oaxaca and Puebla.

Sugar cane, which supplies the raw material for alcohol and refined sugar is grown in 28 of the 32 states and territories. Sulphur deposits in the States of San Luis Potosi, Veracruz and others are more than ample to supply the domestic chemical industry. Mexico is one of the largest growers of limes which are the raw material for citric acid and lime oil. Substantial amounts of both animal fats and vegetable oils are generally available in Mexico for the soap industry.

Vast quantities of salt are recovered from the waters along the east and west coasts and from inland deposits. Mexico is one of the leading producers of arsenic and mercury. Pine forests are plentiful for the recovery of naval stores. Lime is found in several localities.

Some research and development work is carried on, in fact, in recent years there has been considerable increase due partly to the increase in technical graduates of the local universities. Most of the research work has been in connection with public health, for the control of malaria and other tropical diseases.

The National University of Mexico is graduating more and more chemical engineers each year and the newer Technical Institute in Mexico City is gradually getting its chemical engineering department into operation. In addition to the chemists and engineers who graduate from local institutions many young Mexicans attend universities in Texas and elsewhere in the United States and return to their own country to enter the chemical industry.

Young Mexican chemists and engineers are brought to the United States for advanced training by U. S. concerns which have joined with Mexican capital in launching mixed capital enterprises. Upon completion of their training in the U. S., the young Mexicans return to join the technical staffs of the associate Mexican companies.

Among the concerns which announced the training of Mexican nationals in technical

**Celanese Mexicana, S. A., cellulose acetate yarn plant at Ocotlan, Jalisco, is jointly financed by Celanese Corp. of America and Mexican interests**

**REQUIREMENTS MET BY DOMESTIC PRODUCTION**

| Inorganic | | Organic | |
|---|---|---|---|
| Ammonium sulphate | 25% | Acetic acid | 1% |
| Bismuth salts | 75% | Acetone | 5% |
| Calcium chloride | 10% | Acetylene | 100% |
| Calcium phosphate | 70% | Benzol | 100% |
| Chlorine | 10% | Butane | 50% |
| Copper sulphate | 5% | Butyl alcohol | 70% |
| Hydrochloric acid | 30% | Calcium carbide | 100% |
| Hydrofluoric acid | 10% | Castor oil (refined) | 5% |
| Hydrogen peroxide | 20% | Citric acid | 5% |
| Lead arsenate | 80% | Ethane | 50% |
| Mercuric chloride | 70% | Ethyl alcohol | 100% |
| Sodium carbonate | 1% | Formaldehyde | 0% |
| Sodium hydroxide | 1% | Glucosates | 80% |
| Sodium phosphate | 10% | Glycerine | 70% |
| Sodium silicate | 40% | Hormones | 40% |
| Sodium sulphate | 20% | Lactates | 50% |
| Sodium sulphide | 10% | Liver extracts | 25% |
| Stannous chloride | 10% | Menthol | 10% |
| Stannous oxide | 40% | Methyl alcohol | 5% |
| Stannic sulphate | 10% | Nitric ether | 20% to 100% |
| Sulphur | 50% | Stearic acid | 30% |
| Sulphur dioxide | 30% | Sulphuric ether | 20% to 100% |
| Sulphuric acid | 80% | Tartaric acid and salts | 30% |
| Zinc oxide | 40% | | |

**NEW CHEMICAL MANUFACTURING COMPANIES NOT YET IN PRODUCTION**

| Name and Address | Products | Capital | |
|---|---|---|---|
| | | Dollars (U.S.) | Pesos |
| Salico, S. A.<br>Marsella 54, Mexico, D F | Acetyl-salicylic acid, salicylates, phenol, acetic acid | 125,000 | 600,000 |
| Salinas del Pacifico, S. A.<br>Palma 45, Mexico, D F | Salt, sodium sulphate | 208,333 | 1,000,000 |
| Cia. Mexicana de Hielo Seco, S. A.<br>San Pedro Palacho, Veracruz | Carbon dioxide | 41,667 | 200,000 |
| Productos Quimicos Boyle, S. A.<br>I. la Catolica 45, Mexico, D F | Potassium chlorate, caustic soda | 52,083 | 250,000 |
| Colorantes de Mexico, S. A.<br>I. la Catolica No. 33, Mexico, D F | Mono-azo dyes | 52,083 | 250,000 |
| Sosa Texcoco, S. A.<br>San Cristobal Xapepec, Edo. Mexico | Soda ash, caustic soda, salt | 2,083,333 | 10,000,000 |
| Cia. Industrializadora del Lirio, S. A.<br>Av. Juarez 64, Mexico, D F | (To manufacture potassium chlorate and potassium chloride from lillies.) | 52,083 | 250,000 |

and industrial know-how are the Westinghouse Electric Corp., the Celanese Corp. of America, and Reynolds Metals Co.

A few of the most interesting Mexican chemical products and industries have been selected for special attention. They appear below in alphabetical order.

*Alcohol*—Large quantities of ethyl alcohol are produced from sugar cane molasses, which is plentiful, in the states of Veracruz, Sinaloa, Puebla, and Jalisco. There are in the neighborhood of 100 plants, of which the most important are: Atincingo, San Cristobal, Cuatotolapan, La Iberia, El Mante, San Martin, San Miguelito, Motzorongo, San Nicholas, El Potriro and Victoria. Their production is distributed through the Sociedad Nacional de Productores de Alcohol. This organization controls the market and manufactures special denatured alcohols for use in hospitals, in perfumes and in other industrial products. In 1939 combined investments of plants in the Sociedad group totaled $1,544,300, and the annual production was valued at $2,793,000, and since that time production has more than doubled.

Production of alcohol has risen rapidly from 6,090,300 gal. in 1940, to 6,805,500 gal. in 1941, to 9,133,000 gal. in 1942, to an estimated 12,000,000 gal. in 1943. Of the foregoing 360,000 gal. were denatured in 1940, 473,000 gal. in 1941 and 510,250 gal. in 1942. In the war years exports of alcohol from Mexico were substantial, in 1942 they totaled 1,321,700 gal. and in the first nine months of the next year they reached 3,693,000 gal. This large increase in exports was due to an agreement made by Mexico with the U. S. to sell part of her production. Wines and other alcoholic beverages were also exported in large volumes.

*Acids*—The consumption of sulphuric acid by textile, chemical, explosives, mining, fertilizer and steel industries has been increasing in recent years. Sulphuric acid is made by several manufacturers. Fabrica de Acidos, La Viga, S. A., (the former German-owned plant that has since been taken over by the Mexican Government), and Hard Chemical Works, S. A., are making acid at Mexico City. Petroleos Mexicanos is making acid at two of its refineries. Guanos y Fertilizantes de Mexico, S. A., is now producing acid near Cerritos in the state of San Luis Potosi and will shortly have a new contact acid plant in operation. It is being built by Chemical Construction Corp. American Smelting & Refining Co. (Cia. Carbonifera de Saxonas, S. A.) is making acid at Nueva Rosita in the State of Coahuila. This plant utilizes the sulphur dioxide obtained from the roasting of zinc concentrates. The company produces annually about 20,000 tons of 98 percent acid and 2,000 tons of zinc sulphate.

Exports of sulphuric acid were made to the U. S. in 1938 and '39; they amounted to 200 and 748 tons respectively. No exports are shown for the year 1940 and 1941. Imports were 119 tons in 1938, 49 tons in 1939, 316 tons in 1940, 697 tons in 1942 and 84 tons in 1945.

Hard Chemical Works of Mexico City produces hydrochloric and nitric acids. Fabrica de Acidos La Viga makes both of these mineral acids and in addition acetic acid. Productos Quimicos Mexicanos, S. A., produces hydrochloric acid from chlorine generated in its Nelson cells. Nitric acid is made by Cia. Mexicana Explosivos.

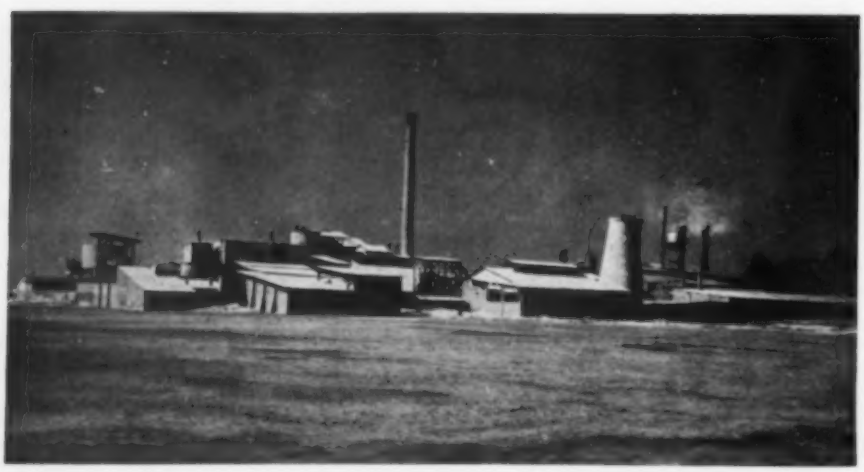
*Arsenic*—The Republic ranks among the world's leading producers of arsenic. Its production of white arsenic is a byproduct in the smelting of principally arsenical lead ores at the plant of the American Smelting & Refining Co. at San Luis Potosi and that of the American Metal Co. at Torrean, Coahuila. Prior to the war Mexico was the source of about one-third of the supplies of the United States. In 1942 increased production in the U. S. caused this country to depend on Mexico for only one-fifth of its requirements. Imports from Mexico increased from 8,133 tons in 1939 to 15,974 in 1943, but dropped to 8,743 tons in 1944. The Mexican arsenic bearing ores are gradually being exhausted, therefore a drop in the production of arsenic is to be expected. In recent years the production of calcium arsenate has been started.

*Calcium Carbide and Acetylene*—Calcium carbide production is somewhat more than 10,000 metric tons annually. The two producers are: Cia Mexicana de Carburo de Calcio, S. A., in Mexico City; and Cia Mexicana Aga., S. A., at Guadalajara, Jalisco. The Mexico City plant is slightly smaller than the other.

The total production of these two plants is sufficient to meet the demands of the local industry which means the acetylene plants. Nevertheless some importations have been made in recent years. For instance, in 1940, 56 tons of carbide were imported and 769 tons the following year. On the other hand about one-tenth of the local production of carbide is exported to other Latin American countries.

Acetylene is used for welding, and for industrial and farm illumination, and is purchased by the government for harbor and navigation lights. The largest producer of acetylene is the Gas Acetileno A. G. A.

**Productos Quimicos Mexicanos' plant at Mexico City, is one of the country's largest and most important chemical plants**



which makes 90 percent of the country's total in its plants at Mexico City, Monterrey, Tampico, Guadalejará, and Mazatlan. It is said to have plans for a plant at Puebla. Among the other producers are: Cia. Mexicana de Soldadma Autogena; Commonwealth Products Co. of Mexico, S. A.

Apparently the local production has been increased so as to meet the demands. Imports decreased from 55 tons, gross weight, in 1935 to 35 tons in 1937 and to only 20 tons in 1941.

*Caustic Soda and Soda Ash*—At the present time the only commercial production of caustic is at the Mexico City plant of Productos Quimicos Mexicanos, S. A. This is one of the largest and most important Mexican chemical plants. It has 240 Nelson cells which serve as the basis of most of its products, liquid chlorine, caustic, (48 percent solution) calcium hypochlorite, calcium chloride, precipitated calcium carbonate, calcium arsenate, hydrochloric acid, carbon bisulphate and potassium chlorate. Electrochemical industries in the Federal District obtain power at 6.2 mils per kw.hr.

This firm has been producing annually about 1,500 metric tons of caustic which is sold to the nearby refinery of Pemex and to some extent to the soap and textile industries. Between 1939 and 1943 another company operated a plant near Mexico City. It produced small quantities from Texcoco Lake bed deposits. Due to operational difficulties and insufficient funds production was suspended.

Total output of caustic in 1940 was 685 metric tons; in 1941, 2,642 tons; in 1942, 1,490 tons; in 1943, 980 tons; in 1944, 1,698 and in 1945 it is estimated to have been about 1,200 tons.

## IMPORTS OF INSECTICIDES INTO MEXICO

[Pounds]

| Commodity | 1938 | | 1941 | | 1944 | |
|---|---|---|---|---|---|---|
| | Total | From U.S. | Total | From U.S. | Total | From U.S. |
| Arsenate and arsenite of calcium and preparations | 75,291 | 75,146 | 740,153 | 740,153 | 546,130 | 546,130 |
| Arsenate and arsenite of copper and preparations | 22,317 | (*) | 25,557 | (*) | 6,136 | (*) |
| Arsenate and arsenite of lead and preparations | 27,784 | (*) | 145,131 | (*) | 230,122 | (*) |
| Arsenates and arsenites, unspecified | 80,560 | 58,865 | 150,790 | 146,900 | 130,253 | 130,253 |
| Bordeaux mixture | 12,794 | (*) | 1,100 | (*) | 8,375 | (*) |
| Calcium cyanide (for fumigation) | 695 | (*) | 209 | (*) | 110 | (*) |
| Chlorobenzene (for fumigation) | 5,388 | (*) | 21,835 | (*) | 22,880 | (*) |
| Copper sulphate | 2,974,653 | 2,917,523 | 3,140,282 | 3,140,130 | 8,003,281 | 8,003,281 |
| Creolin | 138,000 | 18,152 | 121,438 | 108,482 | 188,718 | 181,200 |
| Cresylic acid | 626,600 | 311,680 | 739,105 | 484,792 | 563,055 | 452,175 |
| Disinfectants derived from coal tar, unspecified | 42,858 | 29,548 | 155,738 | 154,376 | 115,284 | 115,284 |
| Disinfectants for rooms and sanitation services, unspecified | 31,594 | 25,476 | 55,575 | 29,119 | 58,890 | 58,890 |
| Disinfectants, unspecified, for external use | 40,047 | 30,558 | 49,247 | 42,394 | 54,404 | 54,404 |
| Formaldehyde | 155,085 | 47,372 | 57,187 | 56,344 | 524,751 | 524,751 |
| Insecticidal preparations derived from pyrethrum (liquid) | 30,147 | 28,970 | 278,298 | 277,281 | 383,670 | 383,670 |
| Insecticide preparations, unspecified | 84,467 | 49,383 | 188,480 | 186,353 | 549,285 | 549,278 |
| Insecticides in an oil solution | 11,185 | (*) | 11,284 | (*) | 2,422 | (*) |
| Naphthalene | 60,740 | 667 | 50,375 | 30,428 | 44,772 | 10,865 |
| Nicotine sulphate | 12,065 | 12,065 | 17,479 | 17,479 | 8,830 | 8,830 |
| Paris green | 500 | (*) | 580 | (*) | 5,933 | (*) |
| Potassium and sodium fluorides | 4,875 | (*) | 108,992 | (*) | 83,380 | (*) |
| Total | 4,437,665 | (†)3,605,405 | 6,059,136 | (†)5,413,991 | 11,540,681 | (†)11,019,011 |

*Not available. †Total of items recorded—distribution by countries of origin not available in all cases

Source: Bureau of Foreign and Domestic Commerce.

Consumption has been about 30,000 metric tons per year. At the present time it is being consumed at this same rate. However, there has been a gradual increase due to the expansion of the petroleum refining, textiles, soap and vegetable oil industries. Soap has consumed 64 percent, petroleum refining 14 percent; textiles 10 percent, vegetable oils 8 percent, and miscellaneous industries 4 percent.

Imports were 16,545,263 kg. in 1938, 16,753,792 in 1940, 27,326,850 in 1942, 16,015,586 in 1943 and 22,310,818 in 1944. During these years the United States has supplied 99 percent of the imports.

Next year the situation should change for the plant at San Cristobal Xetepec, near Mexico City, of the Sosa Texcoco, S. A., will be in operation, provided equipment can be obtained. It is expected to have an output of 100 tons per day of soda ash from which 30 tons will be converted into caustic. When

## COMPANIES PRODUCING CHEMICALS AS BYPRODUCTS

| Name and Address | Products | Capital | | Employees | Annual Business Volume | |
|---|---|---|---|---|---|---|
| | | Dollars (U.S.) | Pesos | | Dollars (U.S.) | Pesos |
| La Luz, S. A.<br>Nonoalco y Cedro, Mexico, D F | Glycerine, soap, vegetable oils | 416,667 | 2,000,000 | 80 | 1,666,667 | 8,000,000 |
| Colgate-Palmolive-Peet, S. A.<br>Czda. de la Ronda 51, Mexico, D F | Glycerine, soap | 416,667 | 2,000,000 | 105 | 1,666,667 | 8,000,000 |
| La Economica, S. A.<br>Naranjo 268, Mexico, D F | Glycerine | 104,167 | 500,000 | 35 | 416,667 | 2,000,000 |
| Bola de Nieve, S. A.<br>Laguna de Terminos, Mexico, D F | Glycerine, vegetable fats | 312,500 | 1,500,000 | 60 | 625,000 | 3,000,000 |
| Cia. Metalurgica Penoles, S. A.<br>16 de Sept. 57, Mexico, D F | Arsenic, lead, zinc | 625,000 | 3,000,000 | 500 | 1,250,000 | 6,000,000 |
| Cia. Minera Asarco, S. A.<br>Madero 55, Mexico, D F | Arsenic, lead, zinc | 2,083,333 | 10,000,000 | 1000 | 4,166,667 | 20,000,000 |
| Petroleos Mexicanos<br>Av. Juarez 92, Mexico, D F | Tetra-ethyl lead, sulphuric acid, wax, petroleum derivatives | | | | | |
| Sociedad Nacional de Productores de Alcohol, S. R. L. de I. P. de C. V.<br>San Juan de Letran 37, Mexico, D F | Representing 65 producers of ethyl alcohol | | | | | |

this plant is in operation local production of caustic should account for 30 percent or more of Mexico's requirements.

Soda ash requirements also have been on the increase in recent years due to the glass industry, which has accounted for 75 percent of the total consumption. The remainder of the demand has come from the manufacturers of sodium silicate, soap, and other products. Almost all of the ash used in Mexico is imported from the U. S. Imports have increased from 47,000,000 lb. in 1941 to 82,000,000 in 1944. The latter were valued at a million dollars.

The Lake Texcoco development previously referred to is interesting. It started out to be a land reclamations project financed by the government. Later the Sociedad Mexicana de Credito Industrial, S. A., set up a corporation with a capital of five million pesos for the exploitation of the salts dissolved in the waters of the lake. The operation company is Sosa Texcoco, S. A.

The salts are dissolved by well and river water and pumped into a caracol which is a solar evaporator of 2,000 acres or the size of Central Park in New York. From it are evaporated 40,000 cu.m. of water per day. The concentrated solution which collects in the center of the caracol is now being pumped to a 10 ton per day pilot plant near the evaporator. The solution is treated with carbon dioxide, bicarbonate settles out in Dorr thickeners and is centrifuged. The partially dried bicarbonate is burned in furnaces to remove carbon dioxide (which is used in treating the original liquor). Salt is removed, purified and sold. The buildings for a plant ten times the size of the pilot plant have been completed and when equipment that has been on order for many months is obtained it can be expected to operate. This is a splendid appearing plant, complete with laboratories, office buildings, hospitals, dining room, all enclosed in the customary Mexican 8-ft. concrete wall.

*Coal Tar Dyes*—At present Mexico makes none of the coal tar dyes it consumes, however a Mexico City company has announced its intentions of coupling imported intermediates and raw materials to form finished products of the monoazo class of dyes. Production is not expected to exceed 60 metric tons (132,276 lb.) a year.

The annual consumption of coal tar dyes in Mexico averages about 2,500,000 lb. or 1,100 metric tons on the "as shipped" basis. Imports are generally of "multiple strength" dyes and both imports and consumption figures would be three to five times as high if reported on a single strength basis. Value of consumption is about 3 million dollars. Textiles require 80 percent of the consumption; leather, 8 percent; paper, 3 percent; and miscellaneous 9 percent. An expansion in the textile industry during the war years developed a slight increase in consumption. The current year will probably show a decline of 10 to 15

## CHEMICAL MANUFACTURING COMPANIES IN MEXICO

| Name and Address | Products | Capital | | Employees | Annual Business Volume | |
|---|---|---|---|---|---|---|
| | | Dollars (U.S.) | Pesos | | Dollars (U.S.) | Pesos |
| Acidos, Organicos, S. A.<br>Tlalnepantla, Edo. de Mexico | Yeast (projected: acetic acid, lactic acid, citric acid, calcium acetate) | 125,000 | 600,000 | 30 | 62,500 | 300,000 |
| Baterias Mexico, S. A.<br>Penitenciaria 34, Mexico, D F | Copper sulphate, mercury salts | 20,833 | 100,000 | 25 | 166,667 | 800,000 |
| Beick, Felix y Cia., S. A.<br>Fab. de Acidos "La Viga," S. A.<br>Calz. de la Viga 54, Mexico, D F | Sulphuric acid, nitric acid phosphates, copper sulphate, sulphuric ether, hydrochloric acid, sodium sulphate, glue, carbon dioxide | 2,083,333 | 10,000,000 | 800 | 3,125,000 | 15,000,000 |
| Fertilizantes de Mexico, S. A.<br>Monte de Piedad 15, Mexico, D F | Calcium arsenate, superphosphate | 104,167 | 500,000 | 64 | 312,500 | 1,500,000 |
| Productos Revuelta, S. A.<br>Granada 96, Mexico, D F | Sodium sulphite, sodium sulphate, citric acid, stearic acid, magnesium sulphate | 104,167 | 500,000 | 44 | 312,500 | 1,500,000 |
| Industrias Proquifa, S. A.<br>Dr. Cesimiro Liceaga 41, Mexico, D F | Copper salts, mercury salts | 41,667 | 200,000 | 18 | 62,500 | 300,000 |
| Hard Chemical Works, S. A.<br>Lago Sirahuen 49, Mexico, D F | Essential oils, hydrogen peroxide, mercury salts, sulphuric ether, nitric ether, sodium sulphate, sulphuric acid, hydrochloric acid | 312,500 | 1,500,000 | 67 | 625,000 | 3,000,000 |
| General de Quimica, S. A.<br>Calz. San Juan Aragon 214, Villa Madero, D F | Sodium hypochlorite, sodium sulphate, zinc salts | 104,167 | 500,000 | 25 | 312,500 | 1,500,000 |
| Cia. Mexicana de Carburo de Calcio, S. A.<br>Morelos 76-A, Mexico, D F | Calcium carbide, oxygen, acetylene | 312,500 | 1,500,000 | 100 | 625,000 | 3,000,000 |
| Cia. Mexicana de Oxido de Zinc, S. A.<br>Alamo 219, Mexico, D F | Zinc oxide, pigments | 10,417 | 50,000 | 17 | 31,250 | 150,000 |
| Destilacion de Madera, S. A.<br>Priv. Victor Hugo 3, Mexico, D F | Acetic acid, methyl alcohol, acetone | 20,833 | 100,000 | 20 | 31,250 | 150,000 |
| Carburo, S. A. | | 208,333 | 1,000,000 | 65 | 312,500 | 1,500,000 |
| Laboratories Quimicos, S. A.<br>Calz. Mexico-Puebla K.7, Mexico, D F | Cacodylates, tartarates, essential oils | 4,667 | 200,000 | 32 | 62,500 | 300,000 |
| Cromo Industrial, S. A.<br>Nardo 219, Mexico, D F | Lead arsenate, copper arsenate, copper sulphate | 1,042 | 50,000 | 12 | 20,833 | 100,000 |
| Productos Quimicos Mexicanos, S. A.<br>Monte de Piedad 15, Mexico, D F | Calcium hypochlorite, caustic soda, chlorine, calcium arsenate, hydrochloric acid, calcium chloride, precipitated calcium carbonate, carbon bisulphide | 625,000 | 3,000,000 | 120 | 625,000 | 3,000,000 |
| Productos de Zinc, S. A.<br>Monterrey, N. L. | Zinc oxide | 15,625 | 75,000 | 14 | 31,250 | 150,000 |
| Quimica del Norte, S. A.<br>Padre Mier 223, Monterrey, N. L. | Acetic acid, acetone, methyl alcohol, creosote, carbon | 31,250 | 150,000 | 37 | 62,500 | 300,000 |
| Azufre Refinado, S. A.<br>Cipres 377, Mexico, D F | Refined sulphur | 20,833 | 100,000 | 15 | 4,667 | 200,000 |
| Azul de Ultramar, S. A.<br>Calle 4 No. 46, San Pedro de los Pinos, D F | Ultramarine blue, pigments | 31,250 | 150,000 | 23 | 62,500 | 300,000 |
| Hectamil, S. A.<br>San Bartolo Naucalpan, Edo. de Mexico | Ultramarine blue, pigments | 20,833 | 100,000 | 18 | 41,667 | 200,000 |
| Salinas de Mexico, S. A.<br>Salinas, S. L. P. | Salt, sodium sulphate | 1,250,000 | 6,000,000 | 800 | 2,083,333 | 10,000,000 |

percent. Most dyes in prewar years were supplied by Germany, but since the start of the war the U. S. has supplied 85 percent and Switzerland the remaining.

*Fertilizers*—Fertilizer consumption is in the neighborhood of only 30,000 metric tons annually, notwithstanding there are an estimated 20,000,000 acres of land under cultivation. In other words very little fertilizer is used in Mexican agriculture since less than 1 percent of the land is fertilized. As a result of constant cultivation of the majority of the arable lands over a period of many years, Mexican soils are practically depleted of the fertilizing elements necessary to produce satisfactory crops. It is estimated that to fertilize only the principal crops, such as corn, wheat, cotton, beans, sugar cane, tomatoes and oil seed 3 million tons of fertilizer would be needed.

Fertilizer consumption is very low owing principally to lack of training of the farmer although during the war consumption has also been restricted by the shortage of supply and transportation. The trend in the consumption of fertilizers of all types has been upward during the past decade and it is expected to continue indefinitely. The government is mindful of the necessity to increase the food supply and is strongly behind the movement to use more fertilizers. This governmental influence may bring about as much as 100 percent increase in the use of fertilizer during the next five or ten years.

The fertilizer materials that are needed in the country are ammonia salts and phosphates. Phosphate deposits at present discovered are low grade and it will be necessary initially to import rock. The ammonia salt most practical for production and distribution in Mexico is the sulphate, a small amount of which is now made as a by-product of coke production at Rosita. Studies of agricultural needs indicate a probable near future annual demand for superphosphate (18 percent $P_2O_5$) of 133,500 metric tons.

Only two chemical fertilizers are produced in the country, ammonium sulphate and normal superphosphate. Only one company has produced the former and its production has averaged 3,000 metric tons annually for the past decade. A large organization is now bidding for a 50 ton a day ammonia unit of one of the Defense Plant Corp.'s surplus plants in the Southwest. If successful in its bidding the unit will be moved to Mexico and used in the production of ammonium sulphate.

There are two producers of standard superphosphate. The plant located at Torren, Coahuila, produces 6,000 metric tons per year from phosphate rock. The Mexico City plant makes 2,000 tons per year principally from bones. A third concern, Guanos y Fertilizantes, S. A., semi-official, has under construction a superphosphate plant of 75 to 80 tons per day at San Luis Potosi (Chemical Construction Corp. is building the plant). Total Mexican capacity for

## CHEMICAL MANUFACTURING COMPANIES IN MEXICO — Continued

| Name and Address | Products | Capital | | Employees | Annual Business Volume | |
|---|---|---|---|---|---|---|
| | | Dollars (U.S.) | Pesos | | Dollars (U.S.) | Pesos |
| Carbonato de Calcio, S. A.<br>Calle 18 No. 9, San Pedro de los Pinos, D F | Calcium carbonate | 20,833 | 100,000 | 18 | 62,500 | 300,000 |
| Guanos y Fertilizantes de Mexico, S. A.<br>V. Carranza 25, Mexico, D F | Sulphuric acid, ammonium sulphate, super-phosphate, bird guano, bone meal, fish meal | 2,083,333 | 10,000,000 | 200 | 416,667 | 2,000,000 |
| Cia. Mexicana de Azufre, S. R. L.<br>Balderas 44, Mexico, D F | Sulphur | 41,667 | 200,000 | 20 | 62,500 | 300,000 |
| Cia. Industrial Dermaton, S. A.<br>Sabino 360, Mexico, D F | Sulphonated oils, pigments | 20,833 | 100,000 | 12 | 41,667 | 200,000 |
| Cia. Mexicana Aga, S. A.<br>Clavijero 40, Mexico, D F | Calcium carbide, acetylene, oxygen | 312,500 | 1,500,000 | 95 | 625,000 | 3,000,000 |
| Cia. Nacional de Oxidos, S. A.<br>Nonoalco 130, Mexico, D F | Zinc oxide, pigments, lead oxide | 52,083 | 250,000 | 28 | 72,917 | 350,000 |
| Silicatos de Mexico, S. A.<br>Nino Perdido 82, Mexico, D F | Sodium silicate | 15,625 | 75,000 | 16 | 31,250 | 150,000 |
| Productos Tanicos, S. A.<br>S'Mor y Riviresa 50, Mexico, D F | Tannin compounds | 15,625 | 75,000 | 9 | 31,250 | 150,000 |
| Cia. Carbonifera de Sabinas, S. A.<br>Nueva Rosita, Coahuila | Sulphuric acid, ammonium sulphate, benzene, toluene, naphthalene, xylols, creosote | 1,666,667 | 8,000,000 | 600 | 3,333,333 | 16,000,000 |
| Hachmeister de Mexico, S. A.<br>Madero 35, Mexico, D F | Ultramarine blue, pigments, tin oxides, tin sulphate | 31,250 | 150,000 | 20 | 62,500 | 300,000 |
| Sulphatos de Cobre, S. R. L.<br>Bajio de Todos Santos 89, Mexico D F | Copper sulphate | 5,208 | 25,000 | 9 | 10,417 | 50,000 |
| Materias Primas Minerales, S. R. L.<br>San Antonio Abad 19, Mexico, D F | Talc, calcium carbonate, lime | 10,417 | 50,000 | 13 | 31,250 | 150,000 |
| Azteca, S. A.<br>Calle 16 y Central, San Pedro de los Pinos, D F | Lime | 20,833 | 100,000 | 20 | 62,500 | 300,000 |
| Calidra, S. A.<br>FF.CC. Nacionales 155, Mexico, D F | Lime | 62,500 | 300,000 | 35 | 125,000 | 600,000 |
| Agustin Argenti<br>Colon 815, Guadalajara, Jal. | Insecticides, zinc oxide | 20,833 | 100,000 | 15 | 41,667 | 200,000 |
| General Electroquimica, S. A.<br>Eligio 7-A, Mexico, D F | Calcium arsenate, lead arsenate | 20,833 | 100,000 | 18 | 41,667 | 200,000 |
| Productos Cantabria, S. R. L.<br>Inglaterra y Roble, Guadalajara, Jal. | Calcium carbonate, activated carbon | 10,417 | 50,000 | 12 | 31,250 | 150,000 |
| Productos Electroquimicos, S. A.<br>El Ancona 68, Mexico, D F | Ammonium persulphate, hydrogen peroxide | 20,833 | 100,000 | 20 | 41,667 | 200,000 |
| Roy-Ort, S. R. P.<br>Fermin Riestra 468, Guadalajara, Jal. | Carbon dioxide, magnesium carbonate | 10,417 | 50,000 | 14 | 31,250 | 150,000 |
| Nitromex, S. A.<br>Calle 2 No. 6, San Pedro de los Pinos, D F | Sodium and potassium chlorates | 52,083 | 250,000 | | | |
| Cia. Nacional de Acidos, S. A.<br>San Luis, Potosi<br>(55% owned by Guanos y Fertilizantes de Mexico, S. A.) | Sulphuric acid | 312,500 | 1,500,000 | 15 | | |
| Industria Mexicana de Tintas<br>Bahia Concepcion 3, Mexico, D F | Printing ink | | | 75 | | |

## UNITED STATES EXPORTS OF PLASTICS MATERIALS TO MEXICO

| | Synthetic gums and resins | | Pyroxylin (sheets, rods and tubes) | | Cellulose acetate (Sheets, rods, tubes, etc.) | |
|---|---|---|---|---|---|---|
| | Pounds | Dollars | Pounds | Dollars | Pounds | Dollars |
| Average during prewar years (1936-39) | 217,113 | 39,477 | 2,810 | 2,069 | 1,731 | 843 |
| 1940 | 432,369 | 110,292 | 2,668 | 2,006 | 26,408 | 14,019 |
| 1941 | 315,458 | 68,197 | 8,096 | 8,137 | 337,984 | 133,058 |
| 1942 | 465,601 | 106,171 | 16,809 | 18,204 | 402,264 | 184,129 |
| 1943 | 560,794 | 157,839 | 27,791 | 27,199 | 208,434 | 86,439 |
| Average during war years (1940-43) | 443,556 | 110,625 | 13,841 | 13,886 | 243,772 | 104,411 |

Source: Bureau of the Census, United States Department of Commerce.

## MEXICO IMPORTS INTO U.S., 1944

| Commodity Description | Quantity | $ Value |
|---|---|---|
| Rubber guayule | 15009057 lb. | 3351233 |
| Turpentine spirits | 795265 gal. | 525448 |
| Chicle crude | 17487968 lb. | 9773812 |
| Gums and resin NES | 518210 lb. | 193384 |
| Rosin not for violins | 3214300 lb. | 145944 |
| Jalap | 79252 lb. | 27580 |
| Sarsaparilla root | 53564 lb. | 7106 |
| Roots veg crude no ochi NES | 311690 lb. | 24920 |
| Cr. drug flowers fruit etc. | 81554 lb. | 8252 |
| Fish livers for drugs | 2285105 lb. | 1631455 |
| Fish liver oil NES advanced | 2871 lb. | 1536 |
| Taxabl oil in fish liver oil | 2857 lb. | |
| Castor beans | 96957 lb. | 1996 |
| Flaxseed | 445502 bu. | 1357734 |
| Sesame seed | 61839 lb. | 8116 |
| Soybeans | 2557 lb. | 502 |
| Vegetable wax candelilla | 6711191 lb. | 1848832 |
| Oiticica oil | 70657 lb. | 14485 |
| Geranium oil | 8 lb. | 140 |
| Rose oil or otto of roses | 1 oz. | 18 |
| Lemon grass oil | 1058 lb. | 743 |
| Lavender oil | 55 lb. | 1193 |
| Lime oil | 126392 lb. | 682405 |
| Lignaloe oil or bois de rose | 116875 lb. | 299293 |
| Orris oil | | 16 |
| Patchouli oil | 16 lb. | 268 |
| Vetivert oil | 36 lb. | 1113 |
| Oil essent a dist no alc NES | 1 lb. | 106 |
| Saffron crude | 3467 lb. | 2113 |
| Dyeing articles crude NES | 2346 lb. | 1311 |
| Dead or creosote oil | 87681 gal. | 10368 |
| Coal tar medicinals NES | 53 lb. | 236 |
| Caffeine | 20833 lb. | 220519 |
| Ichthyol a sulph bitumens | 52913 lb. | 22022 |
| Uribe concentrates a deriv. | | 5934 |
| Arsenic trioxide | 17483726 clb. | 449517 |
| Naphthenic acids | 8381 lb. | 3594 |
| Ethyl alcohol | 5697082 gal. | 2334123 |
| Argols etc. U90 pct pot bitart | 52500 lb. | 692 |
| Strontianite and celestite | 6340895 lb. | 38191 |
| Coconut shell char | 715904 lb. | 16891 |
| Flavoring ext etc. w.o. alc. | 47 lb. | 706 |
| Zinc sulphate | 1084669 lb. | 28678 |
| Iron oxide a hydrox natural | 55115 lb. | 415 |
| Barytes ore crude | 678 ton | 3551 |
| Guano | 135 stn. | 3124 |
| Dried blood NES | 31 stn. | 1445 |
| Animal manures | 2581 stn. | 15739 |
| Fish scrap and fish meal | 259 stn. | 13330 |
| Fertilizer substances NES | 2920 stn. | 14588 |
| Bombs rockets a fireworks NES | 3292 lb. | 1836 |
| Toilet soap ov 20 cents pound | 1954 lb. | 885 |
| Animal oil in toilet soap | 915 lb. | |
| Coc oil n us in t soap o20c | 5 lb. | |
| Tax oil cont soap ov 20 ct lb | 6 lb. | |
| Medicated soap | 29 lb. | 11 |
| Anim oil in medic soap | 14 lb. | |
| Soap and soap powder NES | 4000 lb. | 570 |
| Floral essences a concretes | 8 lb. | 3968 |
| Mixt cont essential oils etc. | 77 lb. | 905 |
| Perfumery containing alcohol | 857 lb. | 10930 |
| Perfumery not cont alcohol | 5 lb. | 49 |
| Toilet water cont alcohol | 15274 lb. | 29295 |
| Toilet water not con alcohol | | 2 |
| Cosmetics containing alcohol | 1207 lb. | 1646 |
| Cosmetics not cont alcohol | | 429 |

Source: U. S. Bureau of Census

superphosphate production should be approximately 20,000 metric tons by 1947 and may be sufficient to supply the entire local demand.

Mexico produces two natural fertilizers, manure and guano. The semi-official organization, Guanos y Fertilizantes de Mexico, S. A., has been given exclusive concessions to exploit all deposits of guano in Mexico. Production of all types of guano in 1946 is expected to be 3,500 metric tons.

*Industrial Explosives*—For several years the production of dynamite has averaged between 16 and 18 million pounds and black powder about 500,000 lb. This production has been by an American owned company, a du Pont subsidiary, who has been supplying about 90 percent of the country's requirements of industrial explosives for many years. About 80 percent of the output is used for the mining industry, 15 percent for construction and the remaining 5 percent for miscellaneous purposes. While the trend in production and consumption was up (20 percent) during the war years the present trend is downward.

*Insecticides*—The insecticide industry has expanded to a leading position during the last decade. Its products have increased in value from 1,500,000 pesos ten or twelve years ago to 3,500,000 pesos in 1945. And indications are that the market will go to from 8 to 10 million pesos in the next few years, due to activity in the trade, health control measures promoted by the Ministry of Public Health, and government educational programs.

Production and imports have increased in recent years. The U. S. has been called on to supply most of the imports. About $800,000 worth of insecticides, fungicides, disinfectants and materials for their preparation were shipped from the U. S. to Mexico in 1943 and 1944. Copper sulphate accounted for one-half of the trade.

About 4,000 metric tons of copper sulphate are used annually on the banana plantations and another 2,000 tons on the citrus fruits, grapes and for other purposes.

In some years as much as 5,500 metric tons of arsenicals have been used, however in a normal year about one-half that amount is consumed. Following is a breakdown of the average annual production:

| | |
|---|---|
| White arsenic | 1,500,000 lb. |
| Calcium arsenate | 4,000,000 lb. |
| Lead arsenate | 220,000 lb. |
| Paris green | 45,000 lb. |
| Others | 100,000 lb. |

Calcium arsenate and fly sprays are the only insecticides made in large quantities. At the present time several small plants for the production of insecticides are under construction and indications are that the capacities of established plants will shortly be expanded.

*Mercury*—Production of mercury has risen rapidly in recent years due entirely to an increase in price. From an output of 254,269 kg. in 1939 it rose rapidly to 401,715 in 1940, to 797,623 in 1941, to the all-time high of 1,118,369 in 1942 but tapered off in 1943 to 976,326 and in 1944 to 898,470. When the price dropped from $196 a flask to $96 in 1944 the small high-cost producers closed down.

*Naval Stores*—Strange as it may seem, the eruption of a volcano was required to disrupt the naval stores industry. The coming of the volcano, Paricutin, damaged a large portion of the producing area destroying many trees and damaging others over an area of several hundred square miles in the States of Jalisco and Michoacan. This destruction lowered the output of the industry in 1944. In the normal years before this event the industry produced 13,000 metric tons of rosin and 3,200 tons of turpentine. The output in the war years was also affected by labor shortages and transportation difficulties.

*Paints and Varnishes*—The paint and varnish industry has increased in importance during the past decade. From 22 factories, the industry has grown to 36. The most important producers are Productos Solex, S. A.; Ambra, S. A.; Productos Piel Roja, S. A.; Pinturas Morlac, S. de R. L.; Productos Optimus, S. de R. L.; Productos Aurolin, S. A.; Productos Var-Mex, A. en P.; Cia. Mexicana de Pinturas "International," S. A.; Esmaltes y Lacquers, S. A.; Productos Lac-co, and Rapidol, S. A.

Annual sales of the industry are now about $4,000,000. It is generally believed that this industry will continue its upward swing.

*Pharmaceuticals*—The average Mexican is a relatively large consumer of pharmaceuticals. This has resulted in a large number of important manufacturers and hundreds of small laboratories which specialize in proprietary and non-proprietary medicines. Many of the large United States drug houses are in Mexico. Such names as Sidney Ross, Abbott, Wyeth, Squibb, Sharp & Doame, Parke Davis

## UNITED STATES EXPORTS OF CHEMICALS TO MEXICO IN 1945

| Commodity Description | Unit | Quantity | $ Value |
|---|---|---|---|
| Citric acid | lb. | 282,552 | 64,254 |
| Oxalic acid | lb. | 127,407 | 16,155 |
| Acids and anhydrides NES | lb. | 336,534 | 60,550 |
| Hydrochloric acid | lb. | 121,761 | 7,843 |
| Boric acid | lb. | 279,145 | 14,967 |
| Chromic acid | lb. | 3,958 | 1,036 |
| Nitric acid | lb. | 22,500 | 3,400 |
| Sulphuric acid fuming | lb. | 35,957 | 2,031 |
| Sulphuric acid NES | lb. | 131,916 | 5,219 |
| Arsenious oxide | lb. | 752 | 329 |
| Molybdenum trioxide | lb. | 142 | 240 |
| Phosphoric acid | lb. | 44,761 | 4,390 |
| Inorganic acid anhydride NES | lb. | 20,714 | 5,800 |
| Methanol | gal. | 2,342 | 943 |
| Ethylene glycol | lb. | 25,008 | 2,622 |
| Denatured alcohol solidified | lb. | 120 | 37 |
| Butanol | lb. | 3,634 | 483 |
| Glycerin | lb. | 1,050,545 | 162,295 |
| Alcohols NES | lb. | 724,260 | 77,936 |
| Acetone | lb. | 308,886 | 26,467 |
| Butyl acetate | lb. | 48,403 | 8,532 |
| Carbon bisulphide | lb. | 450,685 | 32,936 |
| Formaldehyde 40 pct. solution | lb. | 343,231 | 19,814 |
| Paraformaldehyde solid | lb. | 2,650 | 590 |
| Amyl acetate | lb. | 5,507 | 1,746 |
| Celulose acetate flake, etc. | lb. | 5,569 | 1,108 |
| Carbon tetrachloride | lb. | 97,362 | 7,752 |
| Ethyl acetate | lb. | 228,133 | 28,265 |
| Sodium acetate | lb. | 56,398 | 3,731 |
| Methyl ethyl ketone | lb. | 2,938 | 277 |
| Ethyl ether | lb. | 54,982 | 9,197 |
| Camphor natural synthetic | lb. | 10,133 | 5,284 |
| Hexamethylene tetramine | lb. | 21,306 | 7,836 |
| Organic chemicals NES | lb. | 869,396 | 316,636 |
| Aluminum sulphate | lb. | 783,328 | 12,243 |
| Aluminum chloride anhydrous | lb. | 2,263 | 262 |
| Aluminum compounds NES | lb. | 1,786,616 | 72,285 |
| Calcium hypochlorite | lb. | 11,247 | 2,999 |
| Bleaching powder NES | lb. | 984,088 | 28,170 |
| Calcium carbide | lb. | 539,681 | 24,574 |
| Calcium chloride | lb. | 1,032,513 | 18,876 |
| Bromine | lb. | 416 | 470 |
| Potassium bromide | lb. | 8,276 | 2,101 |
| Sodium bromide | lb. | 6,425 | 1,545 |
| Ethylene dibromide | lb. | 4,500 | 1,260 |
| Bromine bromide bromates NES | lb. | 24,315 | 12,911 |
| Potassium iodides | lb. | 5,668 | 8,324 |
| Iodine crude and resublimed | lb. | 5,598 | 8,120 |
| Iodine NES | lb. | 1,276 | 3,899 |
| Potassium bichromate chromate | lb. | 75,380 | 9,876 |
| Potassium hydroxide | lb. | 151,692 | 14,471 |
| Potassium carbonate & mix. | lb. | 385,061 | 28,222 |
| Potassium bitartrate & mix. | lb. | 2,758 | 2,046 |
| Potassium chlorate and mix. | lb. | 1,090,957 | 144,788 |
| Potassium cyanide & mixtures | lb. | 17,035 | 6,536 |
| Potassium nitrate S P May 1, 1937 | lb. | 1,525 | 543 |
| Potassium nitrate NES | lb. | 417,109 | 30,942 |
| Potassium permanganate & mix. | lb. | 60,262 | 18,208 |
| Rochelle salts | lb. | 172 | 126 |
| Potassium compounds NES | lb. | 76,748 | 17,327 |
| Sodium metaborate | lb. | 8,849 | 1,165 |
| Sodium tetraborate | lb. | 2,769,306 | 95,401 |
| Borates NES | lb. | 173,998 | 2,485 |
| Sodium silicate | lb. | 584,395 | 13,261 |
| Soduim carbonate calcined | lb. | 80,614,754 | 1,045,675 |
| Sodium bicarbonate | lb. | 6,440,131 | 151,939 |
| Sodium bichromate & chromate | lb. | 702,647 | 68,228 |
| Sodium cyanide | lb. | 35,622 | 4,727 |
| Sodium hydroxide | lb. | 39,729,103 | 955,339 |
| Sodium phosphate | lb. | 903,571 | 83,726 |
| Sodium hydrosulphite & comp. | lb. | 350,859 | 48,171 |
| Sodium chlorate | lb. | 40,975 | 4,683 |
| Sodium perborate | lb. | 18,632 | 3,327 |
| Sodium compounds NES | lb. | 7,797,335 | 214,401 |
| Tin compounds | lb. | 1,354 | 856 |
| Aqua ammonia | lb. | 186,374 | 6,767 |
| Ammonium bicarbonate & carb. | lb. | 443,081 | 30,696 |
| Ammonium chloride | lb. | 220,866 | 13,485 |
| Ammonium nitrate | lb. | 5,706,990 | 245,239 |
| Urea ammonium | lb. | 188,982 | 12,428 |
| Ammonium compounds NES | lb. | | 42,703 |
| Ammonia anhydrous | lb. | 918,116 | 80,774 |
| Gaseous refrigerants NES | lb. | 143,627 | 40,468 |
| Chlorine | lb. | 719,131 | 28,340 |
| Helium gas | cu. ft. | 65,300 | 890 |
| Gases lung irritant NES | lb. | 280 | 140 |
| Gases screening smoke | lb. | 705 | 928 |
| Gases liquefied, solid, NES | lb. | 467,327 | 59,603 |
| Antimony oxides | lb. | 10,000 | 1,525 |
| Antimony salts & comp. NES | lb. | 33,337 | 6,405 |
| Bismuth nitrates and mix. | lb. | 14,516 | 17,884 |
| Bismuth carbonates & mix. | lb. | 8,126 | 12,079 |
| Bismuth salts & comp. NES | lb. | 6,251 | 13,984 |
| Cadmium salts and compounds | lb. | 20 | 35 |
| Chromium salts & comp. NES | lb. | 11,341 | 2,035 |
| Cobalt salts and comp. NES | lb. | 9,526 | 7,402 |
| Cupric oxide | lb. | 1,556 | 425 |
| Cuprous oxide | lb. | 2,430 | 660 |
| Copper salts & compounds NES | lb. | 19,828 | 2,330 |
| Manganese dioxide, all grades | lb. | 495,154 | 19,878 |
| Manganese salts and comp. NES | lb. | 112,834 | 4,153 |
| Mercurous chloride | lb. | 87 | 225 |
| Mercuric chloride | lb. | 291 | 725 |
| Mercuric oxide red & yellow | lb. | 58 | 215 |
| Mercury salts & comp. NES | lb. | 174 | 574 |
| Nickel salts and compounds | lb. | 79,220 | 27,407 |
| Radium salts and compounds | mgm. | 321 | 7,374 |
| Strontium nitrate | lb. | 21,973 | 3,171 |
| Strontium salts & comp. NES | lb. | 629 | 564 |
| Titanium salts & comp. NES | lb. | 5,000 | 800 |
| Tungsten salts and compounds | lb. | 39 | 121 |
| Uranium salts and compounds | gm. | 21,821 | 350 |
| Vanadium oxide | lb. | 5,642 | 4,389 |
| Vanadium salts & comp. NES | lb. | 55 | 103 |
| Zinc chloride | lb. | 103,612 | 6,836 |
| Zinc sulphate | lb. | 5,905 | 1,102 |
| Zinc salts & comp. NES | lb. | 122,216 | 13,788 |
| Zirconium oxides | lb. | 49,400 | 12,339 |
| Zirconium salts & comp. NES | lb. | 10,950 | 1,631 |
| Platinum salts & compounds | oz. | 39 | 191 |
| Plat. group salts & comp. NES | oz. | 3 | 67 |
| Phosphorus elemental | lb. | 85,409 | 42,112 |
| Industrial chemicals NES | | | 175,310 |
| Ocher, umber & iron oxide NES | lb. | 330,135 | 33,870 |
| Pigments mineral earth NES | lb. | 979,876 | 34,988 |
| Zinc oxide | lb. | 197,042 | 15,624 |
| Lithopone | lb. | 2,281,784 | 107,356 |
| Lampblack | lb. | 36,898 | 4,109 |
| Carbon black or gas black | lb. | 4,835,794 | 240,050 |
| Red lead, dry | lb. | 102,535 | 10,369 |
| Litharge | lb. | 150,643 | 17,445 |
| White lead, dry | lb. | 73,490 | 6,766 |
| White lead in oil | lb. | 32,087 | 3,852 |
| Titanium dioxide & pigments | lb. | 777,138 | 91,514 |
| Pigments chrome 10 pct. chrom. | lb. | 141,999 | 26,943 |
| Sublimed lead dry | lb. | 4,215 | 359 |
| Zinc sulphide | lb. | 4,322 | 2,444 |
| Pigments chemical NES | lb. | 905,174 | 288,246 |
| Paints bituminous, liq., plast. | | | 182,134 |
| Red lead in oil | lb. | 3,906 | 1,317 |
| Paint colors paste oil NES | lb. | 443,576 | 145,572 |
| Water paints dry | lb. | 415,307 | 41,299 |
| Emulsion paints | gal. | 43,002 | 64,201 |
| Water paints paste form | gal. | 40,914 | 58,299 |
| Lacquers nitrocell, pigmented | gal. | 78,413 | 186,501 |
| Lacquers nitrocell, clear | gal. | 19,389 | 38,356 |
| Thinners for nitrocell, lacq. | gal. | 92,175 | 89,372 |
| Rdy. mxd. paints stains enmls. | gal. | 361,222 | 739,760 |
| Varnishes, oil, spir, nat., syn. | gal. | 94,826 | 167,231 |
| Ammonium sulphate | lb. | 9,873,520 | 173,745 |
| Calcium nitrate | lb. | 120 | 46 |
| Sodium nitrate NES | lb. | 2,480,305 | 53,443 |
| Urea | lb. | 17,600 | 801 |
| Nitrog. chem. materials NES | lb. | 83,303 | 2,833 |
| Phos. rock Fla. land pebble | ton | 51 | 620 |
| Normal superphosphate | lb. | 24,110 | 353 |
| Concentrated superphosphate | lb. | 24,400 | 621 |
| Phos. fertilizer material NES | lb. | 140,557 | 7,456 |
| Potassium chloride | lb. | 1,147,356 | 17,348 |
| Potassium sulphate | lb. | 925 | 167 |
| Pot. fert. mat. k20 20 pct. & ov. | lb | 705,100 | 4,421 |
| Pot. fert. mat. k20 under 20 pct. | lb. | 500 | 60 |
| Fert. nitrog phosphatic types | lb. | 13,250 | 834 |
| Fert. mix. prepared | lb. | 58,240 | 3,157 |
| Powder, smokeless | lb. | 5,988 | 5,274 |
| Dynamite | lb. | 3,733,343 | 424,113 |
| Explosives NES | lb. | 269,348 | 49,864 |
| Soap, medicated | lb. | 1,313 | 699 |
| Soap, toilet or fancy | lb. | 55,743 | 19,013 |
| Soap, laundry | lb. | 12,329 | 1,866 |
| Soap, powdered or flaked | lb. | 108,915 | 21,691 |
| Shaving creams | lb. | 4,340 | 1,131 |
| Shaving cakes, powders, sticks | lb. | 5,319 | 6,046 |
| Scouring bricks, pastes etc. | lb. | 244,209 | 25,817 |
| Soap NES | lb. | 30,466 | 5,042 |
| Dental creams | lb. | 3,289 | 2,998 |
| Dentifrices NES | lb. | 6,949 | 5,282 |
| Talcum powder in packages | | | 15,745 |
| Face and compact powder | | | 135,065 |
| Cold creams | lb. | 17,966 | 11,939 |
| Vanishing creams | lb. | 17,965 | 11,088 |
| Creams lotions balms NES | | | 114,980 |

## UNITED STATES EXPORTS OF CHEMICALS TO MEXICO IN 1945

| Commodity Description | Unit | Quantity | $ Value |
|---|---|---|---|
| Cottonseed oil refined ed. | lb. | 16,786 | 3,930 |
| Soybean oil refined edible | lb. | 1,317 | 239 |
| Peanut oil edible | lb. | 69 | 12 |
| Cocoa butter | lb. | 316,873 | 87,477 |
| Palm & kernel oil ed. or ref. | lb. | 3,264 | 592 |
| Vegetable stearin | lb. | 466 | 186 |
| Vegetable oils & fats ed. NES | lb. | 2,786 | 864 |
| Buna S | lb. | 6,225,359 | 2,151,305 |
| Butyl copolymers, isoprene, etc. | lb. | 24,192 | 7,616 |
| Neoprene polymers, chloroprene | lb. | 390,775 | 169,786 |
| Synthetic rubbers NES | lb. | 591 | 300 |
| Rubber reclaimed | lb. | 762,027 | 54,859 |
| Rubber scrap | lb. | 2,538,026 | 24,052 |
| Rubber cement | gal. | 4,166 | 9,516 |
| Soybeans, except canned | lb. | 470 | 48 |
| Cottonseed | lb. | 6,049,256 | 372,717 |
| Flaxseed | lb. | 574,440 | 34,964 |
| Seeds: hemp, perilla, poppy, etc. | lb. | 1,592 | 414 |
| Coconut oil crude | lb. | 3,248 | 544 |
| Linseed oil | lb. | 26,324 | 4,539 |
| Fatty acids, vegetable origin | lb. | 59,003 | 9,187 |
| Olive oil foots | lb. | 60,640 | 10,447 |
| Vegetable soap stock | lb. | 547,573 | 16,279 |
| Castor oil, commercial | lb. | 6,768 | 1,184 |
| Olive oil ined. ex. sul foots | lb. | 30 | 18 |
| Oil & fat expressed iner. NES | lb. | 8,887 | 5,563 |
| Peppermint oil | lb. | 42,611 | 337,627 |
| Spearmint & other mint oil, NES | lb. | 6,290 | 26,207 |
| Citrus oils | lb. | 10,722 | 53,015 |
| Oil of citronella | lb. | 18,827 | 18,687 |
| Oils not essntl & distld NES | lb. | 23,215 | 76,259 |
| Oils blend etc. perfume flav | lb. | 150,154 | 1,027,949 |
| Logwood extract | lb. | 6,828 | 2,243 |
| Quebracho extract | lb. | 36,104 | 3,157 |
| Extracts dyeing tanning NES | lb. | 600,817 | 50,305 |
| Gum rosin | lb. | 34,390 | 2,605 |
| Wood rosin | lb. | 120,293 | 9,164 |
| Gum spirits of turpentine | gal. | 1,320 | 1,512 |
| Wood turpentine | gal. | 2,234 | 2,670 |
| Pine oil pine oil prod etc. | gal. | 77,466 | 47,293 |
| Tar and pitch of wood | lb. | 962,719 | 52,154 |
| Tall oil | lb. | 88,660 | 14,061 |
| Chicle | lbs | 2,000 | 1,300 |
| Shellac bleached and unbichd. | lb. | 55,474 | 26,788 |
| Rosin NES | lb. | 5,147 | 1,059 |
| Gum benzoin | lb. | 63 | 207 |
| Gums, resins, natural, modified | lb. | 304,589 | 148,843 |
| Gums, resins, natri, crude, NES | lb. | 60,949 | 12,053 |
| Coal tar crude and refined | gal. | 5,180 | 1,149 |
| Benzol or benzene | gal. | 8,436 | 1,295 |
| Coal tar pitch | ton | 24 | 885 |
| Creosote or dead oil | gal. | 502,256 | 71,620 |
| Toluene | lb. | 211 | 47 |
| Xylene | lb. | 9,063 | 473 |
| Naphthalene | lb. | 204 | 31 |
| Pyridine crude or refined | lb. | 4,386 | 1,652 |
| Coal tar crude NES | lb. | 21,980 | 1,241 |
| Phenol carbolic acid | lb. | 28,214 | 4,072 |
| Picric acid | lb. | 206 | 224 |
| Cresylic acid and cresols | lb. | 389,211 | 28,736 |
| Benzoic acid tech. & med. gr. | lb. | 3,739 | 2,058 |
| Salicylic acid tech. & med. | lb. | 5,232 | 1,947 |
| Coal tar acids | lb. | 5,193 | 2,972 |
| Aniline oil | lb. | 1,370 | 222 |
| Aniline salts | lb. | 65,977 | 15,438 |
| Naphthol and flakes beta | lb. | 11,393 | 2,913 |
| Dimethylaniline | lb. | 56 | 35 |
| Diphenylamine | lb. | 5,595 | 4,747 |
| Sodium pentachlorophenate | lb. | 500 | 98 |
| Phthalic anhydride | lb. | 26,909 | 4,163 |
| Tricresyl phosphate | lb. | 2,050 | 650 |
| Dibutyl diethyl phthalat, etc. | lb. | 10,738 | 2,501 |
| Nitro derivatives, benzene, etc. | lb. | 61,894 | 3,421 |
| Coal tar intermediates NES | lb. | 72,415 | 28,387 |
| Rubber compounding agents | lb. | 423,865 | 118,536 |
| Color lakes and toners | lb. | 95,183 | 65,343 |
| Sulphur black | lb. | 202,101 | 49,199 |
| Synthetic indigo | lb. | 131,445 | 88,025 |
| Coal tar dyes NES | lb. | 1,938,498 | 1,790,813 |
| Vanillin all types | lb. | 2,013 | 6,159 |
| Syn. flavor & perfume mat. NES | lb. | 22,220 | 37,684 |
| Methyl salicylate tech. & med. | lb. | 16,265 | 6,061 |
| Sodium benzoate tech. & med. | lb. | 25,421 | 10,783 |
| Photographic chem. coal tar | lb. | 14,999 | 11,727 |
| Coal tar prod. finished NES | lb. | 18,689 | 22,421 |
| Castor oil medicinal | gal. | 183 | 670 |
| White mineral oil | gal. | 273,552 | 102,892 |
| Fish oils and concentrates | lb. | 34,921 | 73,887 |
| Quinine salts, compounds NES | oz. | 106,237 | 55,728 |

| Commodity Description | Unit | Quantity | $ Value |
|---|---|---|---|
| Acetylsalicylic acid tablets | | | 6,484 |
| Belladonna extract ointment | lb. | 662 | 1,821 |
| Hyoscyamus extract | lb. | 153 | 1,086 |
| Scopolamine or hyoscine | oz. | 55 | 775 |
| Tablets, powders, ointment NES | | | 416,905 |
| Atropine sulphate | oz. | 200 | 1,220 |
| Caffeine alkaloid | lb. | 12,605 | 37,721 |
| Caffein salts, compounds | lb. | 643 | 1,814 |
| Radium salts, compounds | mgm. | 631 | 17,440 |
| Strychinine and salts thereof | oz. | 1,011 | 656 |
| Theobromine and salts a comp. | lb. | 1,987 | 6,116 |
| Theophylline salts thereof | oz. | 37,083 | 19,292 |
| Benzocaine, benzoate, etc. | lb. | 2,833 | 15,680 |
| Acetylsalicylic acid in bulk | lb. | 418,267 | 173,129 |
| Acoyophenetidine | lb. | 4,651 | 4,648 |
| Glycerophosphoric acid salts | lb. | 15,627 | 18,639 |
| Phenolphthalein | lb. | 1,376 | 1,287 |
| Sulphanilimide | lb. | 5,113 | 16,066 |
| Sulphathiazole & derivatives | lb. | 86,924 | 282,958 |
| Sulphadiazine & derivatives | lb. | 19,617 | 136,923 |
| Sulphaguanidine | lb. | 8,241 | 45,599 |
| Sulphonamide drugs NES | lb. | 26,055 | 175,489 |
| Medicinal chem. presc. use NES | | | 2,444,348 |
| Liniments | | | 3,465 |
| Cold, cough, etc., preparations | | | 98,563 |
| Laxatives, cathartics, etc. | | | 141,890 |
| Milk of magnesia | | | 5,492 |
| Digestive preparations | | | 121,511 |
| Remedies, headache, neuralgia | | | 138,611 |
| Belladonna, fluid ext., etc. | lb. | 405 | 2,361 |
| Stramonium extract | lb. | 22 | 54 |
| Prep. medicinal prep. NES | | | 614,799 |
| Nicotine sulphate | lb. | 7,934 | 7,135 |
| Copper sulphate | lb. | 5,493,213 | 279,680 |
| Lead arsenate | lb. | 353,310 | 41,365 |
| Calcium arsenate | lb. | 27,360 | 2,192 |
| Petroleum oil sprays agric. | gal. | 3,661 | 2,497 |
| Pyrethrum extract | lb. | 5,975 | 5,734 |
| Seed disinfectants | lb. | 33,022 | 13,172 |
| Paradichlorobenzene | lb. | 20,311 | 2,608 |
| Cupric acetoarsenite | lb. | 7,136 | 1,820 |
| Pyrethrum powders | lb. | 3,267 | 704 |
| Rotenone | lb. | 288 | 52 |
| Calcium cyanide | lb. | 26,153 | 6,175 |
| Insecticides, fungicides, agri. | lb. | 1,008,830 | 233,169 |
| Insecticides etc. H.H. and ind. | lb. | 1,315,163 | 312,422 |
| Disinfectants etc. H.H. and ind. | lb. | 270,160 | 30,082 |
| Baking powder | lb. | 354,682 | 52,387 |
| Dextrine or british gum | lb. | 435,019 | 34,402 |
| Tobacco sauging, tobacco orig. | lb. | 22,250 | 2,753 |
| Pigmented resin emulsion tex. | lb. | 57,856 | 7,632 |
| Detergents dyeing assist. etc. | lb. | 405,261 | 99,183 |
| Textile specialty comps NES | lb. | 911,685 | 168,321 |
| Tanning mixtures chromium | lb. | 622,777 | 49,266 |
| Tanning compounds NES | lb. | 1,880,839 | 193,928 |
| Water softeners etc. | lb. | 2,851,449 | 242,728 |
| Metal working compounds | lb. | 530,285 | 59,623 |
| Ester gums | lb. | 50,840 | 7,854 |
| Alkyd resins | lb. | 146,678 | 27,841 |
| Phenol-formaldehyde resins | lb. | 393,857 | 66,795 |
| Tar acid resins NES | lb. | 90,202 | 14,968 |
| Urea-formaldehyde resins | lb. | 233,556 | 55,709 |
| Urea resins, NES | lb. | 69,022 | 13,182 |
| Casein | lb. | 10,135 | 2,491 |
| Methyl methacrylate unfab. | lb. | 1,418 | 1,782 |
| Gums resins synthetic NES | lb. | 404,685 | 84,583 |
| Polymers of styrene, etc. | lb. | 687,537 | 269,592 |
| Phenol-formaldehyde forms lam. | lb. | 19,909 | 12,855 |
| Urea-formaldehyde forms lam. | lb. | 2,500 | 1,536 |
| Syn. resin NES forms lam. | lb. | 16,549 | 12,581 |
| Phenol-formaldehyde forms and lam. | | 14,460 | 5,796 |
| Methyl methacrylt. forms and lam. | lb. | 6,617 | 7,167 |
| Syn. resin NES forms and lam. | lb. | 2,174 | 2,088 |
| Pyroxylin sheets rods etc. | lb. | 62,903 | 61,146 |
| Cellulose plastic mold comp. | lb. | 678,431 | 246,103 |
| Cellulose acetate sheets etc. | lb. | 17,030 | 36,567 |
| Cellulose plast film support | lb. | 40 | 43 |
| Nitro cell solu. mlt. | lb. | 3,172 | 830 |
| Pectin | lb. | 4,793 | 4,681 |
| Animal charcoal, carbons, etc. | lb. | 722,652 | 70,773 |
| Rubber compound agents NES | lb. | 91,269 | 29,649 |
| Ethyl fluid | gal. | 181,970 | 754,655 |
| Liquid gum inhibitors | | | 18,376 |
| Licorice extract and mass. | | | 8,015 |
| Reagent chemical, laby. use | | | 40,361 |
| Chemical spec. compounds NES | | | 681,997 |
| Acetic acid | lb. | 61,642 | 8,349 |
| Acetic anhydride | lb. | 19,560 | 2,437 |
| Tartaric acid | lb. | 10,757 | 8,110 |

Source: U.S. Bureau of Census, Dept. of Commerce

and American Home Products are well known. E. R. Squibb & Son de Mexico has a penicillin plant that is about completed. A streptomycin plant also is now under construction.

*Plastics*—The growth of the plastic molding industry has paralleled that in the United States, however, production of plastic materials has been limited to a few specific thermosetting plastics materials. The 20 molders have already expanded their manufacturing facilities in anticipation of the time when they can obtain additional molding equipment. The industry has been using about 3,500,000 lb. of plastic materials but shortly this figure should be doubled or even quadrupled.

*Rayon*—In May 1941 a Mexican company, Productora de Artisela, S. A., was organized to produce rayon. Equipment was purchased and moved to Mexico from Hampton Co. manufacturers of rayon at Easthampton, Mass. It had produced 4,750 lb. of viscose rayon daily. This plant was erected at Alvero, Obregon. Later it was taken over by Artisela Mexicana, S. A., (Celanese Corp. of Amer.) and is now being modified so as to produce both continuous and staple fiber.

At the present time Celanese and Mexican interests (Banco Nacional de Mexico) are building a plant in Mexico at Ocotlan, Jalisco, to produce acetate rayon. This plant will be in operation before the end of the year. These interests have selected a location for a large viscose plant which will be operated by Viscosa Mexicana. The two companies which will operate the new viscose and acetate mills have a total capitalization of 35,000,000 pesos. The two mills will produce a total of 10,000,000 to 12,000,000 lb. of rayon yarn.

*Sulphur*—Sulphur has been found in 18 states. The most important of the producing areas is at Cerritos, San Luis Potosi. The production of sulphur-bearing ores in 1943 totaled 26,149,469 kg.; in 1944, 30,511,850; and in 1945, 42,691,060. These ores contain between 15 and 20 percent sulphur.

Recently, two companies, one a government organization, are reported to have under consideration the development of deposits in the Tehauantepec area. One of these companies has commenced drilling. There are rumors that other sulphur deposits are to be exploited but due to poor transportation in the locations where these deposits are located there is not much likelihood of success.

Two chemical companies consume between 3,000 and 4,000 tons of sulphur annually for the production of sulphuric acid. While the chemical industry is the largest consumer of sulphur, substantial amounts go to the fertilizer and insecticide manufacturers, the rubber industry, and the pulp and paper mills. Total consumption is estimated to be about 5,000 or 6,000 tons. Some sulphur is imported from the U. S.

## MADE SUBJECT TO MEXICAN IMPORT RESTRICTIONS

### Nov. 27, 1945

| Schedule Code No. | Commodity |
|---|---|
| 3.23.11 | Calcium carbonate |
| 6.00.90 | Liquid organic acids, not specified |
| 6.00.91 | Solid organic acids, not specified |
| 6.03.93 | Mixtures of ethers and alcohols used in the manufacture of varnishes and colors |
| 6.03.99 | Ethers, not specified |
| 6.05.90 | Salts, not specified, of organic origin, the weight of which including its container exceeds 20 kilos, on condition, besides, that proof be given of its industrial use, subject to the judgment of the Custom's Inspector or on being presented before the Custom's General Administration, on application started on making the inspection. |
| 6.05.91 | Salts of organic origin, not specified |
| 6.06.40 | Acetylene |
| 6.06.80 | Mixtures and preparations of organic origin used in the manufacture of pharmaceutical products. |
| 6.06.81 | Mixture and preparations, not specified, of organic origin, when proof of their industrial use is made, according to the judgment of the Customs Inspector, or on being presented before the Custom's General Administration, on application started on making the inspection. |
| 6.06.82 | Organic mixtures or preparations, even when they have mineral basis, when proof of same is made according to the judgment of the Customs Inspector or before the Customs General Administration, and which products are destined for hastening the vulcanizing of rubber. |
| 6.06.90 | Products of organic origin, not specified, for non-industrial uses. |
| 6.10.90 | Liquid inorganic acids, not specified |
| 6.10.91 | Solid inorganic acids, not specified |
| 6.12.03 | Lead chromate |
| 6.12.41 | Calcium hypochlorite |
| 6.12.46 | Calcium chloride, in flakes, non deliquescent, packed in textile or paper bags, the weight of which, including the container, exceeds 45 kilos. |
| 6.12.53 | Potassium and sodium chlorates. |
| 6.13.30 | Mixtures and preparations of mineral origin used in the manufacture of pharmaceutical products. |
| 6.13.31 | Mixtures and preparations, not specified, of mineral origin, when proof is obtained of their industrial use, according to the judgment of the Customs Inspector, or before the General Customs Administration by application made on inspection. |
| 6.13.36 | Mixtures and preparations of mineral origin used in the manufacture of toilet articles, such products not being perfumed. |
| 6.13.38 | Mixtures and preparations of chlorine basis, used as decolorants by industry. |
| 6.13.90 | Products of mineral origin, not specified, for non-industrial uses. |
| 6.20.23 | Calcium carbide. |
| 6.21.10 | Mixtures and preparations of organometallic origin, used in the manufacture of pharmaceutical products. |
| 6.21.11 | Mixtures and preparations of organo-metallic origin, not specified, when proof is made of their industrial use according to the judgment of the Customs Inspector, or before the Customs General Administration by application made after inspection. |
| 6.21.17 | Mixtures and preparations of organo-metallic origin, used in the manufacture of toilet articles, such products not being perfumed. |
| 6.30.32 | Calcium arsenite or arseniate and their insecticide preparations. |
| 6.30.33 | Copper arsenite or arseniate and their insecticide preparations, the weight of which including the container exceeds 20 kilos. |
| 6.30.34 | Lead arsenite or arseniate and their insecticide preparations. |
| 6.30.35 | Insecticide preparations, liquid, of pyrethrum derived products, even when they contain aromatic materials. |
| 6.30.38 | Arsenites or arseniates, not specified and their insecticide preparations, the weight of which including the container, exceeds 20 kilos. |
| 6.30.39 | Insecticide preparations, not specified. |
| 6.30.46 | Copper aceto-arseniate (paris green). |
| 6.61.00 | Varnishes, shoe polishes, colors and pigments for shoes and leathers, the weight of which including the packing is up to 5 kilos. |
| 6.61.01 | Varnishes, shoe polishes, colors and pigments for shoes and leathers, which do not have a base of alcohols or ethers, included in the classifications 601 and 603 of the Mexican General Imports Tax List the weight of which including the container is not greater than 5 kilos. |
| 6.61.21 | Varnishes and colors prepared with a basis of alcohols or ethers, included in the Classifications 601 and 603 of the Mexican Imports General Tax List, in any kind of container. |
| 6.61.28 | Prepared varnishes and colors not specified, the weight of which including the container is up to 5 kilos. |
| 6.61.29 | Prepared varnishes and colors, not specified, the weight of which including the container exceeds 5 kilos. |

Source: Diario Oficial, Dec. 5, 1945

# PROCESS EQUIPMENT NEWS

THEODORE R. OLIVE, Associate Editor

### ALUMINUM STEPLADDER

WEIGHING only 16 lb. in the 5 ft. size, a line of aluminum folding stepladders is available in sizes of 4, 5, and 6 ft. from Aluminum Ladder Co., Worthington, Pa. The ladder is constructed entirely from aluminum alloy 52S, which has a tensile strength of 37,000 lb. per sq. in. Non-skid treads are provided for safety. Great strength is said to be combined with exceptionally light weight.

### DIFFERENTIAL GAGE

A VARIETY of applications in industrial process control and in laboratory testing operations can be handled with a new differential pressure gage that is being offered by Kollsman Instrument Division of Square D Co., Elmhurst, N. Y. The unit may be calibrated either in inches of water or inches of mercury, with several standard ranges available covering differences in pressure from 50 to 300 in. of water. Gages are compact, with a 3½ in. diameter dial. Accuracy is claimed to be within approximately 1 percent. The gage is mechanical in type, having two pressure connections, one directly to the inside of a metal diaphragm, the other to the airtight case surrounding the diaphragm. Variations in pressure inside the diaphragm, as compared with that in the case, cause expansion or contraction of the diaphragm which is then measured and transmitted to a pointer.

### SELF-PRIMING PUMP

CAPACITIES in the range from 50 to 4,000 g.p.m. are available in the Type E line of industrial self-priming pumps, available in electric and belt-driven models, and announced by Marlow Pumps, Ridgewood, N. J. These pumps have been tested widely in wartime applications and now are being produced for regular industrial purposes. They employ a unique diffuser design which is said to permit them to prime and reprime automatically without recirculation or the use of any automatic mechanical devices. As in regular centrifugal pumps, the impeller alone moves the liquid so that a high degree of efficiency is claimed.

Sizes for these pumps range from 1½ to 10 in., with operating heads from 10 to 150 ft., for the handling of clear, gritty, warm or volatile liquids.

### STEAM CLEANING UNIT

WEIGHING only 28 lb. and easily portable, the Turco Hydro Steam cleaning unit utilizes any available steam supply of 80 to 150 lb. pressure for steam cleaning operations. It is provided with quick couplings to permit fast connection. Three manual controls vary the temperature, quantity of detergent solution used, and the nozzle pressure to handle the needs of any particular job. The device can be adjusted to deliver a high temperature penetrating spray or a moderately warm spray. Any of a wide variety of specialized cleaning compounds produced by this manufacturer can be used, depending on requirements. The cleaner has no moving parts, pumps, pressure tanks, motors, electrical connections or other complications. It is manufactured by Turco Products, Inc., 6135 South Central Ave., Los Angeles 1, Calif.

### JAW CRUSHER

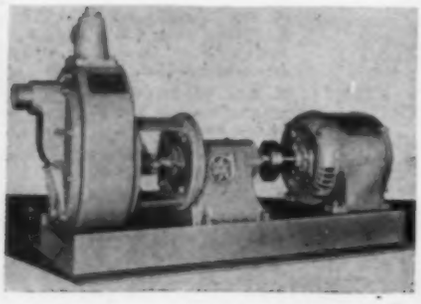
NOVEL principles that are said to result in extremely high efficiency compared with conventional jaw crushers have been incorporated in the design of the new Simplex single-jaw crusher announced by Straub Mfg. Co., 507 Chestnut St., Oakland 7, Calif. Jaw crushers are generally similar to the original Blake design of 50 years ago. In such crushers a considerable part of the power applied is absorbed in friction, in lifting the massive moving parts, and pushing the material being crushed backward toward the feed end as it is nipped. The last mentioned characteristic tends also toward excessive wear. Authorities are quoted as stating that 50 to 70 percent of the full load power is consumed by the crusher running empty, and that at least a 125 percent overload motor is needed for starting. In a typical 30x18-in. machine running at 225 or 250 r.p.m. and drawing about 40 hp. at full load, a 50-hp. motor would be needed for starting, while 20 to 28 hp. would be required to keep it running empty.

By contrast, the accompanying illustration shows a 30x15-in. model of the new Simplex crusher running empty at 380 r.p.m. with a running expenditure of 1½ hp. Note that no

5-ft. aluminum stepladder

Small differential pressure gage


Type E self-priming pump



Turco steam cleaning unit in operation

Simplex crusher, running light, without foundations bolts and with only 1½ hp. for running

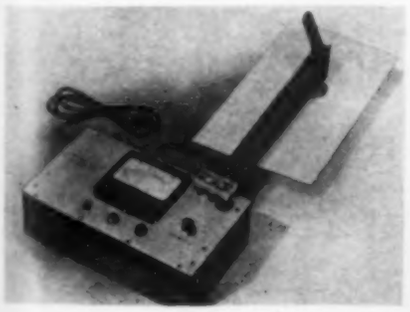
foundation bolts are used in the test installation (indicating no vibration), and that the extra energy required for starting is supplied by the 5-hp. across-the-line-start motor, driving the relatively light fly-drive wheel through a small V-belt. Owing to balanced design and the use of maximum leverages, no other flywheel is needed.

The results noted are achieved by use of a new design of movable jaw, the upper pivot of which lies on the line forming the center of the vee between the two jaws. A pitman operating on an eccentric applies power to the central pivot of a pair of toggle arms which in turn transmit motion to the bottom of the movable jaw. These parts operate in an oil bath, with the motion transmitted to the jaw through a flexible diaphragm. In addition, oil is filtered and circulated by an oil pump on the crusher shaft to bearings above the oil reservoir level. Although it is claimed that there is very little wear (and none of the back-slipping that produces wear in conventional crushers), provision is made to take up wear and backlash automatically in all of the bearings of the pressure-applying system.

## MOISTURE DETECTOR

MODEL S is the designation of a new Delmhorst moisture detector for materials in sheet form which has been announced by Colloid Equipment Co., 50 Church St., New York 7, N. Y. The new detector, resulting from many years of development work by W. J. Delmhorst, operates on a 110 volt a.c. lighting circuit and makes determinations, it is claimed, with an accuracy between 3 and 15 percent, depending on the material tested. In use, the sheet material, which may be up to ¾ in. thick, is slipped into a deep throated arm where it is clamped under always uniform pressure between electrodes. Moisture content is immediately indicated on a meter through the use of a circuit incorporating electronic amplification. Such materials as paper, cardboard and veneer may be handled.

Moisture detector for sheet material



## THREE-WAY VALVE

A FLEXIBLE molded synthetic-rubber tube, incased in a molded plastic body, is used in the new Grove Flex-tube three-way valve introduced by Grove Regulator Co., 65th and Hollis Sts., Oakland 8, Calif. The valve is said to be suitable for handling all types of fluids, including gases, chemicals and liquids, particularly for hydraulic or pneumatic cylinder operation. Since it does not restrict flow the unit is said to be satisfactory for controlling viscous or solids-carrying liquids, while its non-metallic construction permits the handling of highly corrosive or erosive liquids or gases. An over-center cam, operated manually, opens or closes the ports at each half turn of the hand wheel. A special self-locking feature is said to assure positive, tight shutoff over extended periods of time. Sizes available are ⅛ and ¼ in., for working pressures up to 250 lb. and a maximum temperature of 150 deg. F.

Non-metallic three-way valve


## PLASTIC SLIDE RULE

BINDING or sticking of the slide under varying atmospheric conditions are said to be impossible in the new plastic 10-in. slide rule brought out recently by Charles Bruning Co., 4754-10 Montrose Ave., Chicago 41, Ill. Remarkable dimensional stability is claimed for the new material and it is said that the precision graduations are unaffected by temperature changes. The glass indicator is mounted in a polished stainless steel frame which holds it firmly in place. The beveled edges of the rule are graduated in inches and centimeters and the scales include the conventional A, B, CI, C, D, K, S, L and T scales. The tension on the slide is readily adjustable by four screws on the back of the rule.

All-plastic slide rule

Totally inclosed fan-cooled motor

## INCLOSED MOTOR

DESIGNED for use in extremely dusty, dirty and corrosive atmospheres is a new totally inclosed, fan-cooled motor which has been added to the line of Tri-Clad induction motors produced by General Electric Co., Schenectady, N. Y. The new motor, produced in standard, explosion-proof and dust-explosion-proof types in sizes from 1 to 1,000 hp., is suitable for use in Class I, Groups C and D, and Class II, Groups E, F and G hazardous locations. The motor is particularly compact, employing a double-shell, cast-iron frame with cast-iron end shields and conduit box for protection from external blows, dripping water, dust, vapors and corrosive liquids. Cooling is accomplished by a non-sparking external fan which is protected by a cast-iron housing with a screened air intake opening. Designed for full-voltage starting, the motor uses simple, inexpensive control equipment, has a high pull-up torque and high maximum running torque for temporary overloads.

## NEOPRENE COVERALL

IMPERVIOUSNESS to oil and greases, and high resistance to acids and alkalies, is claimed for the new buff colored neoprene-coated coverall introduced by Benson & Associates, 310 South Michigan Ave., Chicago 4, Ill. Produced for this concern by the United States Rubber Co., the coverall completely protects the worker from neck to shoe-tops. Protected zipper closures are provided at the front, at wrists and at ankles. A hood which can be snapped on at the back of the collar, protects the entire head from splashes and spray, and is designed to permit goggles or face masks to be worn comfortably when the hood is in place. The coverall is light in weight, weighing less than 3 lb., and is especially useful for tank cleaning of all types.

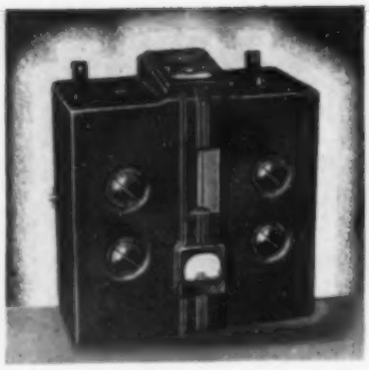
## THERMOCOUPLE TUBE

TO PERMIT measurement of low gas pressures in the range from 0.01 to 100 microns with an accuracy of plus or minus 5 percent, Sylvania Electric Products, Inc., Electronics Division, Boston 15, Mass., has introduced a vacuum measuring device of the thermo-

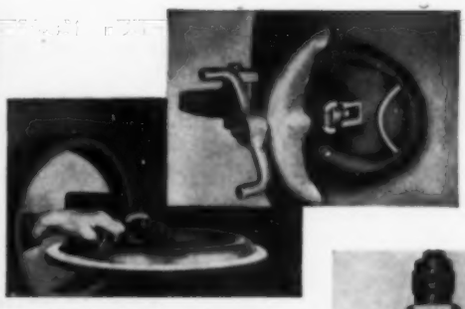
Light-weight neoprene coverall

Vacuum measuring thermocouple tube

Automatic weight adjustor



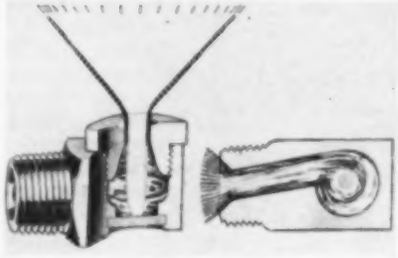
Oxygen-hydrogen indicator



Dual swing cover support

Continuous viscosimeter

Improved spray nozzle



couple type. This consists of a tube with the hot junction of a thermocouple element centered on a filament heater. Measurements of gas pressure are made through variations in thermal conductivity of the gas surrounding the thermocouple. The device resembles a four-pronged vacuum tube which is sealed directly to the evacuated apparatus by means of tabulation provided on top of the bulb. Direct measurement may be made with a 0-250 microammeter which may be calibrated for each gas measured.

## WEIGHT ADJUSTOR

A VARIETY of commodities which flow freely can be packaged to accurate weight through the use of the new automatic weight adjustor manufactured by the Fred Goat Co., 314 Dean St., Brooklyn, N. Y. Operating automatically at high speed, the machine receives partially filled packages from volumetric or rough weight fillers and adds sufficient material to bring the packages up to the desired gross weight. The packages travel through the machine on a conveyor in timed cycles, passing through a series of stations at each of which progressively smaller increments of material are added as required until the package is brought up to the desired final weight. Material is added in each station only if the weight of the package upon reaching that station is below the preset weight limit of that station. The desired minimum weight is thus positively attained and the maximum overweight tolerance is limited to the smallest and final increment. The machine illustrated in the accompanying view handles 60 packages up to 1 lb. in weight per minute, is fully automatic, requiring no operator, and utilizes only a ½-hp. motor.

## OXYGEN-HYDROGEN DETECTOR

BOTH OXYGEN and hydrogen impurities in gases may be detected and measured with the same instrument, a new device known as the Deoxo indicator, that has been put on the market by Baker & Co., Newark 5, N. J. The instrument, originally announced for determining oxygen impurities, has been further refined and is now available for detecting and measuring the presence of hydrogen in inert gases such as nitrogen, carbon dioxide, and saturated hydrocarbon gases. It is available regularly as an indicator but can be provided with a circular chart type potentiometer - recorder and air-operated controller if desired. The presence of from 0.001 to 1.0 percent oxygen impurities can be measured at a conservative accuracy of plus or minus 2 percent of the instrument range.

The instrument operates by measuring the increase in temperature of the gas sample which results from combination of the oxygen impurity with the hydrogen. Except when the sample already contains hydrogen, a small amount is added from a self-contained electrolytic cell. After passing through a drying chamber and an activated carbon purifier, the sample enters a calorimeter containing a precious metal catalyst. During passage over the catalyst, combination of any oxygen present with the hydrogen is effected. The heat liberated is directly proportional to the concentration of oxygen in the sample since an excess of hydrogen is either present or added. A thermocouple is used to measure the temperature rise.

By means of a slight change in the electrolytic cell, whereby excess oxygen instead of hydrogen is introduced into the sample, the instrument may be modified to detect and measure small quantities of hydrogen impurity in other gases. To allow for possible changes in the activity of the catalyst over a long period, a means for readily recalibrating the instrument are provided.

## COVER SUPPORT

ACCESS to pressure vessels of all kinds through manhole openings is facilitated by a new dual swing support for the manhole cover which has recently been introduced by Lenape Hydraulic Pressing & Forging Co., P. O. Box 23, West Chester, Pa. Ordinarily, supports for manhole covers swing the cover inward only. The new support, used in conjunction with Lenape standard elliptical manhole covers, permits such covers to be manipulated and withdrawn through the opening and swung aside so as to be out of the way. Covers so equipped are available in standard sizes for 10x15 to 18x24 in. manholes, for use wherever manways are required for frequent access. Covers are made in carbon and stainless steels.

## CARBIDE-INSERT NOZZLE

INCREASE in service life up to 100 times in a vortex type spray nozzle is claimed for a design change that has been made in its Whirljet nozzles by Spraying Systems Co., 4023 West Lake St., Chicago 24, Ill. The change consists in use of a tungsten carbide insert in the base of the vortex chamber which resists the action of any abrasive particles that may be mixed in the liquid to be sprayed. The terrific whirling action set up in the vortex chamber of nozzles of this type in the past has made them subject to wear from such abrasive particles. The use of the tungsten carbide insert is said effectively to reduce wear from this cause.

## CONTINUOUS VISCOSIMETER

INSTANTANEOUS observation of viscosity values existing in a moving fluid stream under full line pressure is possible with the new continuous viscosimeter recently announced by Fischer & Porter Co., County Line Road, Hatboro, Pa. The instrument is available in simple indicating form or may be arranged if desired for continuously recording viscosity values on a 24-hour chart, or for controlling viscosity by automatic blending or heating means. The device is a modification of the rotameter. The novel departure is in the use of two rotameter bobs in the same tube. One, which is fully compensated for viscosity, is used to adjust the flow rate through the metering tube to a constant and standard value by automatic flow control. The other bob, uncompensated for viscosity, then assumes a position in the tube proportional to the viscosity of the fluid measured at the existing temperature. Calibration of the tube includes an index line for adjusting the flow rate and a viscosity scale. The instrument is

said to be particularly valuable for continuously blending lube oils, indicating the end points in various plastic processes, and in the maintenance of constant fuel oil viscosity for improved burner operation.

### 15-LB. EXTINGUISHER

SIMPLIFIED carrying and operating features are incorporated in a new trigger-touch 15-lb. carbon dioxide extinguisher introduced by Randolph Laboratories, 8 East Kinzie St., Chicago 11, Ill. An accompanying illustration shows the arched steel handle and the operating trigger. Grasping the unit by its handle, the operator removes the extinguisher from its bracket and carries it with only one hand, leaving the other arm free to remove obstacles or open doors en route to the scene of action. On approaching the fire he grasps the nozzle handle with his free hand, aims it at the base of the flames and with one touch of the thumb trigger discharges as much snowy carbon dioxide gas as may be needed. Release of the trigger automatically stops the flow.

### PROTECTIVE LEGGINGS

PROTECTION of the legs and shins of industrial workers against heat, sparks, hot metal and acid splashes and abrasions is afforded by the new Guardwell Frank leggings made by Safety Clothing & Equipment Co., 7016 Euclid Ave., Cleveland 3, Ohio. The body of the legging is made from either Underwriters' grade asbestos, grade 1 chrome tanned heat resistant leather, fireproofed duck, or impregnated synthetic duck, depending on the use to which the leggings will be put. The inside front of the legging is reinforced with heavy canvas and between this canvas and the body of the legging are inserted two pieces of fiber for extra protection against splash and impact. Side stays of non-rusting metal keep the legging in a firm, upright, comfortable position on the leg and provide proper adjustment to any leg size.

Thumb-control 15-lb. extinguisher

Leggings for leg protection

### SPRAY NOZZLES

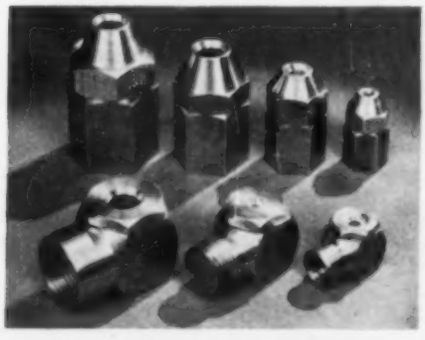
A VARIETY of spray nozzles for the handling of water, oils and other liquids, designed to meet specific requirements for a variety of jobs, has been announced by Delavan Engineering Co., Des Moines, Iowa. Some of the nozzles are shown in an accompanying illustration. Nozzles in the rear row are Types WS and WSS. The former type produces a hollow cone spray and the latter a full cone spray. Available with both female and male pipe thread connections, sizes range from ¼ to 1 in. and capacities from 0.15 to 24 g.p.m.

In the foreground of the illustration, the nozzles are Type WR, available in sizes from ¼ to ¾ in. These various nozzles find application in air conditioning, air washing, humidifying, room cooling, industrial and other uses. They are designed to be taken apart readily for cleaning and present simple design and non-clogging features.

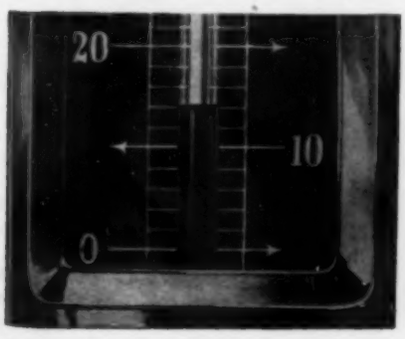
### INDUSTRIAL THERMOMETER

READABILITY is said to have been greatly improved by the introduction of a new type of mercury tube employed in mercury industrial thermometers manufactured by the Philadelphia Thermometer Co., 4401 North 6th St., Phildelphia, Pa. The tube is elliptical in shape, with the bore so placed that the mercury column is magnified to full width of the tube. The yellow tube back, which is equal in width to the mercury column, is visible only above it, forming a sharp color contrast at the point of temperature reading. Thermometer cases and frames are designed to admit maximum light to both tube and calibrated scale, at the same time cutting down glare and reflection.

Spray nozzles of varying characteristics



High visibility industrial thermometer




### PRE-COLLECTOR

WHERE contaminated air that is cleaned by a dust collection system contains materials having a recovery value, or abrasive particles, the new Velocitrap announced by Claude H. Schneible Co., 2827 25th St., Detroit 16, Mich., is useful as a pre-collector. The device salvages valuable materials in a dry state for return to the process and greatly reduces abrasive wear in the duct system and collectors, also eliminating the settling out of materials in the ducts.

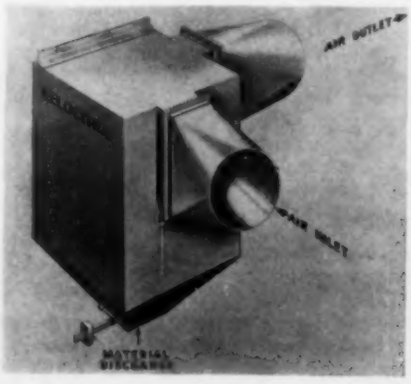
The Velocitrap is placed in the intake duct ahead of the collector and employs slot-shaped openings in an elbow of the duct to separate the larger solid particles by centrifugal force, depositing them in a hopper. Hence only a minimum of the smaller solids reach the dust collector. The device is made in four types for various operating conditions and in a wide range of sizes from 2,000 to 20,000 c.f.m. It may be used in conjunction with any dry or wet dust collection system.

### EQUIPMENT BRIEFS

AN UNUSUAL packaging machine, developed by the Goodyear Tire & Rubber Co., Akron, Ohio, has recently been demonstrated at both the Packaging Exposition in Atlantic City and the Plastics Show in New York. This device, which is used for wrapping individual packages in Pliofilm transparent, waterproof, thermoplastic packaging material, automatically wraps and seals objects of assorted sizes and shapes. The Pliofilm is passed over electrically heated rollers between two high speed foam-rubber belts which cushion the plasticized film tightly around the surfaces of the object to be wrapped, at the same time forcing all air from within the formed closure. Speeds of the belts up to 300 ft. per minute can be used, according to A. B. Clunan, manager of this company's packaging sales division, who invented the machine.

A VARIETY of new switches intended primarily for communications and electronic instrument applications has been announced by General Control Co., 1200 Soldiers

Pre-collector for dust removal



Field Road, Boston 34, Mass. The Model MCF five-position cam-lever switch is locking or non-locking in all positions except the center position, which is always locking. The motion of the switch from the center to all switching positions is straight line. Contacts handle up to 10 amp. at 125 volt a.c. The new Master Model MPB switch is a nine-position push button switch made in both locking and non-locking frame types. The locking frame type has eight positions and one reset position any switching combination previously set being released by one operation of the reset button. The rating is 5-10 amp. at 125 volts a.c.

HITHERTO inaccessible water supplies for fire fighting may be used, employing the pump booster known as the Accel-O-Rate, which has been announced by the Jet Pump Division of Derbyshire Machine & Tool Co., 5215-J Belfield Ave., Philadelphia 44, Pa. Using standard fire pumping equipment, or its equivalent, the booster will lift water vertically 100 ft or more and will draft water for distances of 200-300 ft. from water sources impossible to reach because of gulleys, ditches, mud or other obstacles. The jet pump principle is used, the unit having no moving parts and weighing but 18 lb. It is provided with connections for standard 2½ in. fire hose and is used submerged in the water supply.

TO FACILITATE the making of three-dimensional drawings, Instrumaster Industries, 7326 Arch St., Greenwich, Conn., has introduced a new line of drafting instruments of the stencil type. One type of stencil is suitable for isometric drawings, another for dimetric drawings. The stencils provide inch graduatons at full scale along one vertical and two slanted edges and are provided with 27 elliptical openings correctly representing in the individual projections circles from ⅛ to 2 in. diameter.

FOR FIRST AID use, Mine Safety Appliances Co., Pittsburgh 8, Pa., has introduced the Redi-Heat block, a new rapid and safe emergency heat source requiring no liquids. The block is entirely self-contained and is always ready for instant use, requiring only about one minute to reach top heat. Wrapped in a towel or blanket the block maintains its temperature for approximately one hour and furnishes safe heat for emergency treatment through the chemical action of a newly developed compound.

ARO EQUIPMENT CORP., Bryan, Ohio, has announced a gear-type hydraulic pump designated as Model H657-A which delivers 5½ g.p.m. at 2,800 r.p.m., in pressures up to 2,000 lb. per sq. in. The pump is suitable for a wide variety of hydraulic systems at pressures ranging from 100 to 2,000 lb. The size of the pump is approximately a 3½ in. cube.

## EXAMINE YOUR EXTINGUISHERS

NOW THAT standard fire extinguishers are again available, it is pointed out by Safety Research Institute, New York 17, N. Y., that those responsible for fire protection would do well to examine old and "Emergency Approved" extinguishers for possible replacement. Many extinguishers that should have been retired previously were kept in service during the war because new extinguishers were available only to high priority holders. Sometimes even priority holders had to be satisfied with Emergency Approved extinguishers. The latter, of course, made use of various substitute materials and methods, some of which are not acceptable at the present, and their replacement has been described by Underwriters' Laboratories as a "necessary part of the cost of the war."

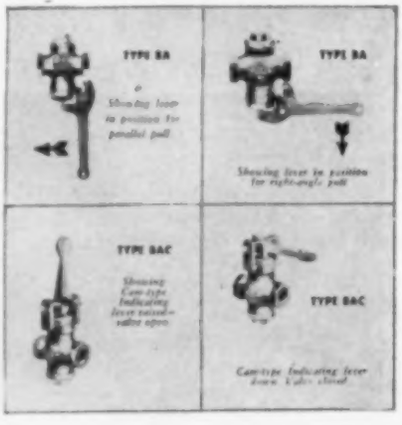
For purposes of identification, it should be noted that standard extinguishers bear the Factory Mutual Approved insignia consisting of the letters F.M. superimposed on a diamond-shaped design and the Underwriters' Laboratories label which reads "Underwriters' Laboratories Inspected." On the other hand, models which were made of substitute materials to meet the war emergency bear the usual approval indication as well as the letters "EAS" and the year the equipment was manufactured. This marking indicates that the equipment may require more careful inspection and maintenance and may not stand up as long as standard types.

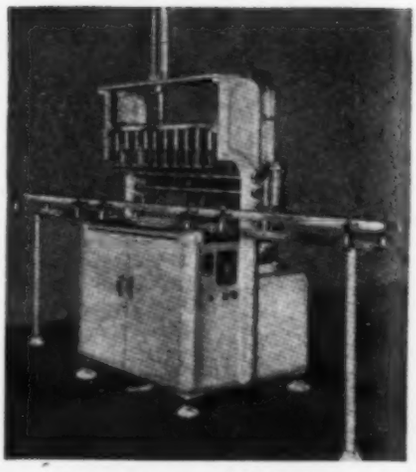
## IMMERSION HEATER

A SELF-CONTAINED unit for installation in industrial water tanks, drums, processing kettles, stills, sterilizers and similar equipment, which provides automatic electric heating for liquids, is available in a new immersion heater announced by the American Instrument Co., Silver Spring, Md. The heater incorporates an automatic temperature control which, once installed and set for the desired working temperature, permits maintenance of any temperature from room temperature to 350 deg.F. with a conservative accuracy of plus or minus 5 deg.F. A built-in safety control limits the temperature rise of the heater and thus protects it against overheating and burning out. should the liquid level fall and expose the heating element to the air.

The heater can easily and quickly be screwed into the walls of a tank or other container through a 1-in. pipe fitting or reducer, only two wires being connected from the current supply to the heater. Two or more such heaters can be installed on one application if desired. The sheath of the heater cannot become electrically

Ball valve showing various lever arrangements



Improved vacuum bottle filler

energized, thus eliminating danger of the material becoming electrically charged. A pilot light is provided to indicate when the heater is functioning. Such heaters are available with copper sheaths for water heating or steel sheaths for light oils, in wattage ratings of 250, 500, 750 and 1,000.

## AIR OPERATING VALVE

SELF-SEALING construction is featured in a new ball-type air operating valve known as Type BA that has been announced recently by the Leslie Co., Grant Ave., Lyndhurst, N. J. The valve is fitted with a hand operating lever and a rotatable pivot so that the lever can be mounted in position for either a horizontal or a vertical pull. The ball valve closes tight with inlet pressure and the stuffing box is self-packed by the operating pressure when the valve is open to permit flow. Operating pressures up to 200 lb. are recommended. As shown in the accompanying illustration the valve can be provided with a cam-operated lever, thus becoming Type BAC. When this cam is used, the lever is held in the position thrown until manually returned to the original position.

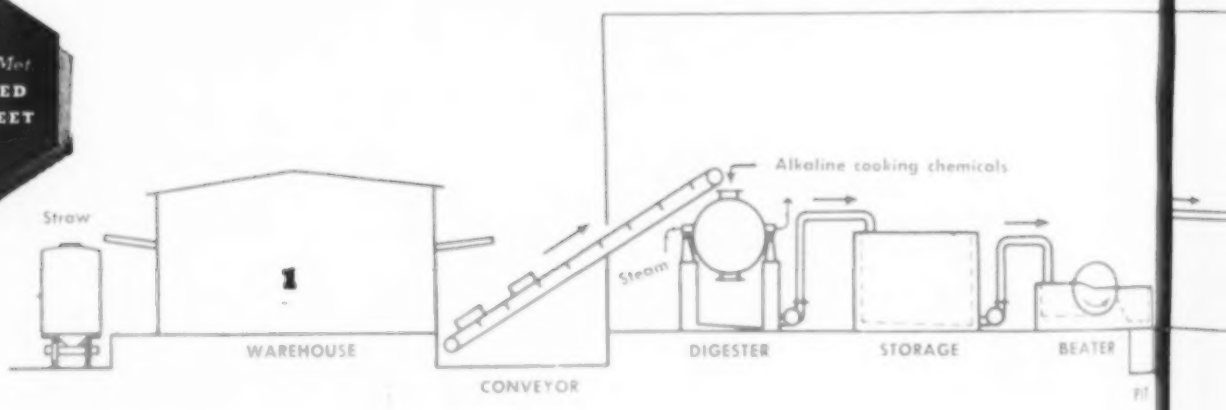
## VACUUM BOTTLE FILLER

PNEUMO-VAC is the name of a new vacuum bottle filler announced by Ertel Engineering Corp., 300 Front St., Kingston, N. Y. The unit is semi-automatic and is suitable for the rapid filling of bottles or jugs within the height range from 3 to 13 in. Its average filling speed measured in quarts is 50 bottles per minute. It is activated by a balanced foot valve which permits free use of the operator's hands, thus reducing physical effort to an absolute minimum. The unit employs newly designed valve-type spouts which are said positively to eliminate drip. The liquid filling height can be accurately and simply regulated and is said not to vary until reset. Liquid contact parts are available either in bronze plated or in stainless steel. The vacuum pumps are automatically lubricated and inclosed in a readily accessible cabinet, along with the vacuum selector valves and motors. Pilot lights indicate position of the vacuum circuits and liquid is supplied to the filler reservoir by gravity from a constant level tank.

Fairfield Aerial Surv

**At the present time several mills are making flax papers of which Ecusta Paper Corp. at Pisgah Forest, N. C., is the largest producer, turning out 50 tons of cigarette and other fine flax papers per day. This mill is undergoing a third expansion**

A *Chem & Met* PICTURED FLOWSHEET




# CIGARETTE PAPER

At the present time several mills are making flax papers of which the Ecusta Paper Corp. at Pisgah Forest, N. C., is the largest producer, turning out about 50 tons of cigarette and fine papers per day.

The raw material is decorticated flax straw which comes from California and Minnesota. From storage the bales are conveyed to the pulp mill where the fiber is loaded into rotary spherical digesters with a capacity of 4½ tons of flax. The cooking solution is made up in measuring tanks, mixed in another tank, and pumped into the digester. The flax is cooked for five hours in the alkaline liquor with 75 lb. steam pressure.

The contents of the digester are washed and dumped into a trench, and then pumped into an agitated storage chest. In breaker beaters the raw stock is given a final washing, and fibers are cut to proper length for this phase of processing. After a short time in a trench it is pumped to storage chests and from them goes to the bleaching system.

The bleached stock is dropped out of the Bellmers, in which the final bleaching action is carried to a definite point as determined by control tests. It then goes to chests and is fed and washed on vacuum washers. The washed stock is conveyed directly to pulp storage.

In the paper mill the wet lap goes into beaters where the inherent strength in the fiber is brought out. Beaters are emptied into machine chests where broke, filler, precipitated calcium carbonate, and water are added. A jordan then completes the refining operation. Stock flows from the jordans to a mixing box where it is diluted and mixed with white water returned from the paper machine. A centrifuge removes foreign particles and screen plates remove fiber knots. The pulp fibers are now completely dispersed and flow to the machine head box, and then onto the fourdrinier wire of the paper machines. Here the pulp suspension, which is 99 percent water at this stage, is converted into paper, passed through a series of steam heated dryer cylinders, and inspected.

For a more detailed account of the operations in the Ecusta Paper Corp.'s Pisgah Forest, N. C., plant the reader is referred to the accompanying illustrated article on pages 94-97.

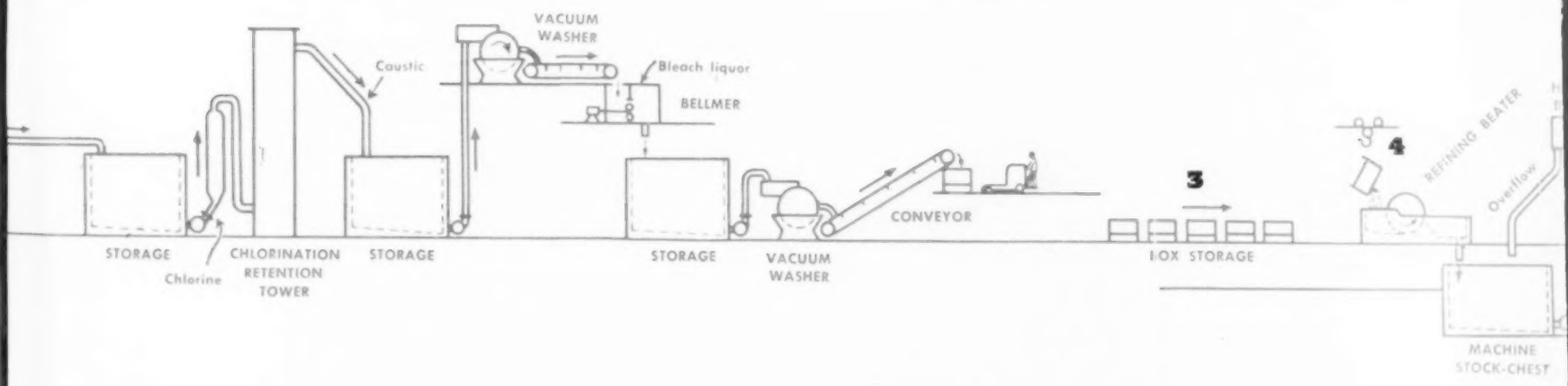

CHEMICAL & METALLURGICAL ENGINEERING

*June, 1946*

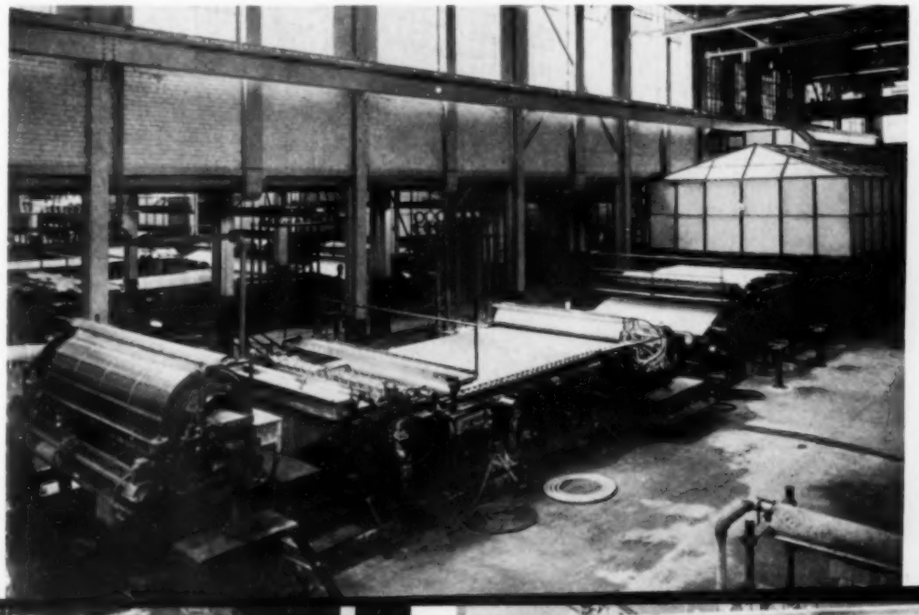
PAGES 138 TO 141

Flax for the Ecusta mill comes from Minnesota and California, the former supplying the greater percentage. California flax supplied by California Central Fibre Corp. is decidedly lighter in color but this difference has no effect on volume of chemicals consumed in processing

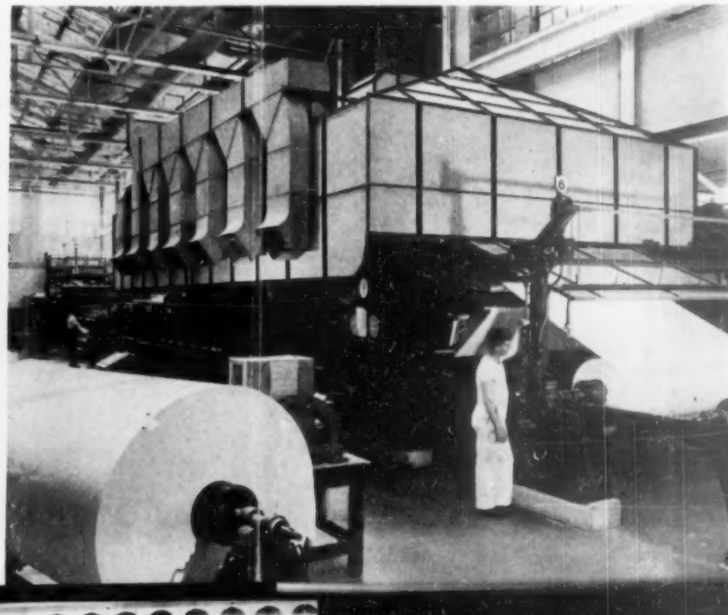

1 Decorticated flax straw in 150 to 160-lb. bales is conveye cars to storage in large warehouses having a floor space o or directly to the pulp mill. A year's requirements must be k




5 The fourdrinier wire is finely built mesh endlessly woven. The pulp suspension which is over 99 percent water at this stage, flows over the wire where a lateral motion helps to interlock fibers into an appropriately formed sheet



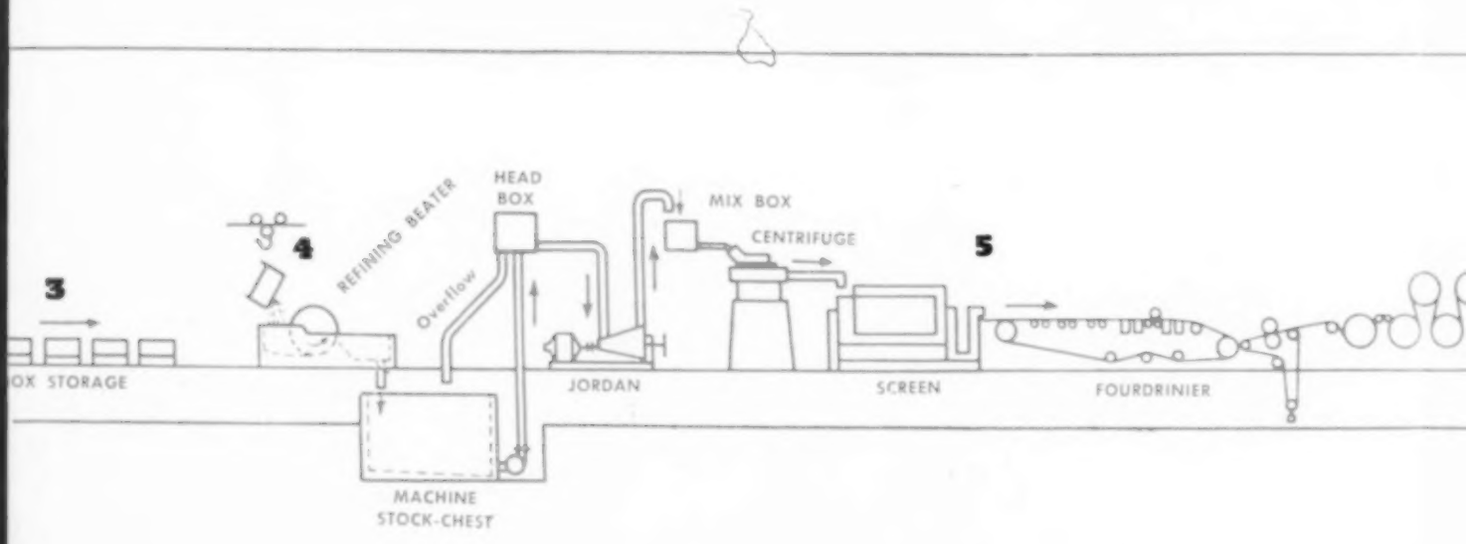
6 Paper has been dried mechanically as far as possible when it leaves the pr The web is then carried through dryer cylinders. Paper is now dry and af under a fluorescent light for rigid inspection is wound on a mandrel



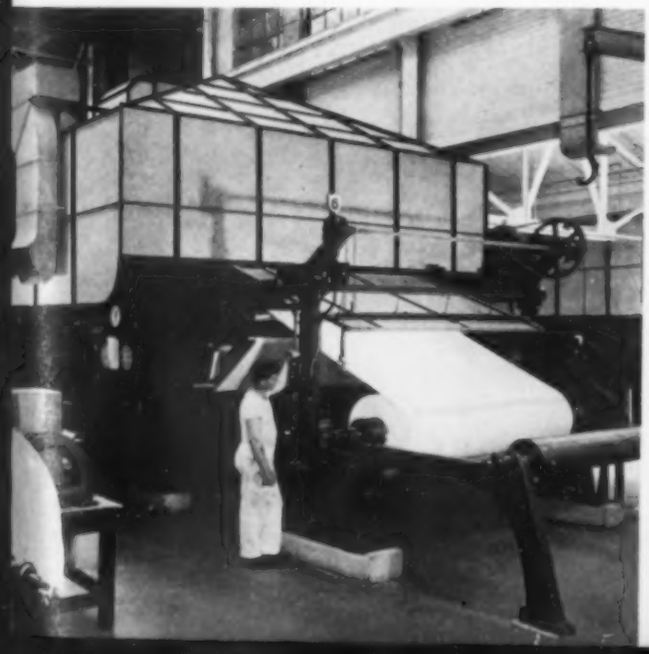

lax straw in 150 to 160-lb. bales is conveyed from box in large warehouses having a floor space of five acres. e pulp mill. A year's requirements must be kept on hand

**2** Straw is loaded into rotary spherical digesters with a capacity of 4½ tons. Cooking solution is made in measuring tanks and pumped to digesters

**3** In the paper m in galvanized iro electric lift truck

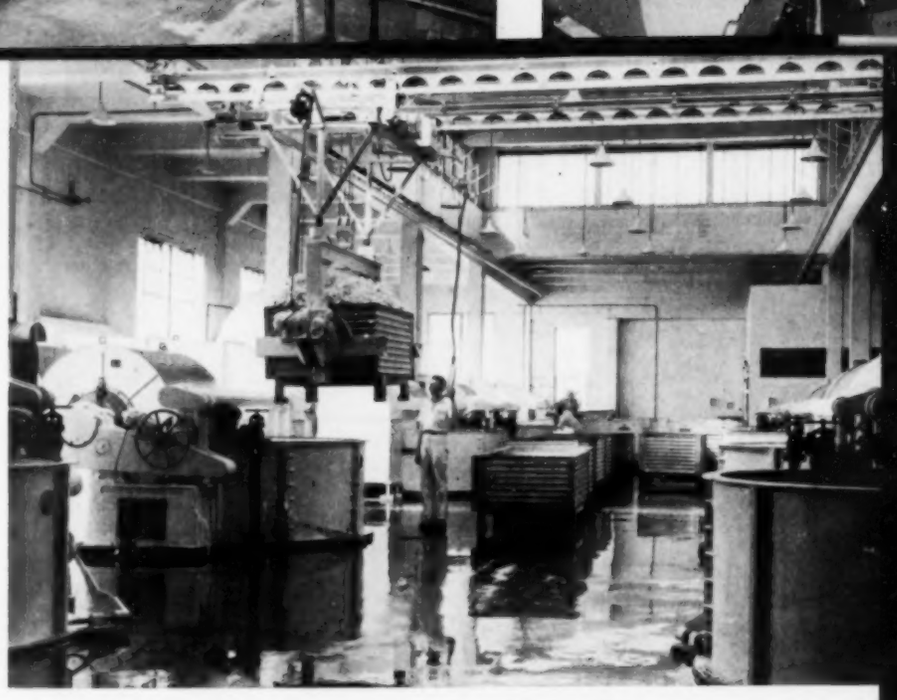



echanically as far as possible when it leaves the press section. hrough dryer cylinders. Paper is now dry and after passing for rigid inspection is wound on a mandrel

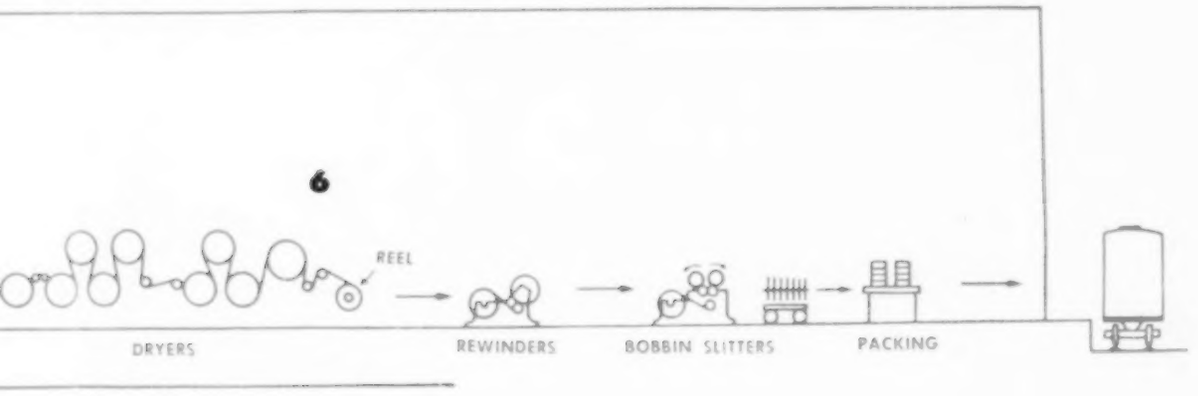


Papermaking requires large volumes of water, 155 gal. per pound o used at Ecusta. The filter plant has a designed capacity of 20 million gall A control board can detect trouble at any point in the filter plant

the paper mill stock is stored in shredded lap form
lvanized iron boxes which can be easily handled by
ic lift trucks or other means

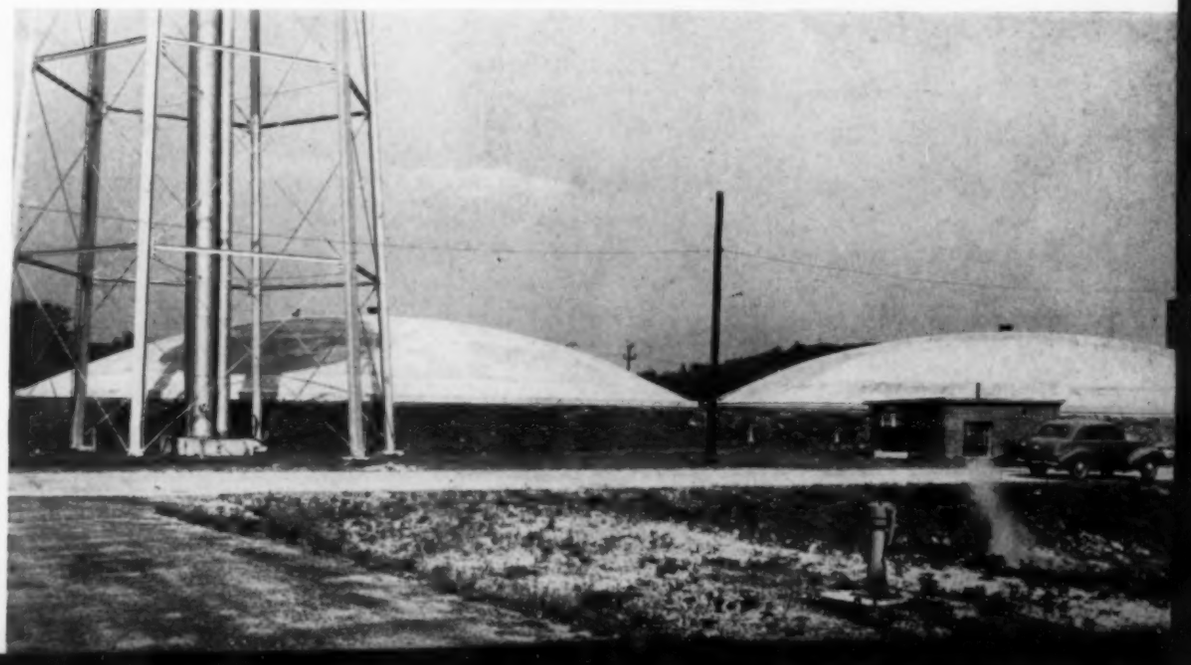


4 When loading the beaters, the appropriate type of stock is selected and conveyed by electric truck to aisles between beaters from which a crane picks up the box and dumps the stock into the beater




per pound of paper are
million gallons per day.
er plant

At all times, 0.2 p.p.m. of chlorine are kept in the water, and a uniform pH is maintained. The filtered water is pumped to two Prestressed Gunite reservoirs with a capacity of one and a half million gallons each. Adequacy of water supply is extremely important

# Whatever the job calls for

# . . . it's in the Crane line

**Take this filter installation for example** . . . or any piping job. What a difference it makes when you can specify all the piping materials from one line. And when just one order gets you all the valves and fittings, pipe, accessories, and fabricated piping.

From start to finish, any piping job is easier when Crane is your partner. The proper equipment for every service is assured. Crane gives you the world's greatest selection of brass, iron, and steel piping materials.

Undivided responsibility for materials helps you get the best installations. Uniform Crane quality . . . the standard of quality for more than 90 years . . . in every part means uniform dependability throughout piping systems.

This 3-way advantage of standardizing on the Crane line is the sure way to reduced piping costs. Can you afford to overlook it?

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SOURCE OF SUPPLY
RESPONSIBILITY
STANDARD OF QUALITY





(*Right*) **UNCOMMON QUALITY** *in commonly used valves—Crane Standard Iron Body Wedge Gate Valves. Improved body design reduces weight yet increases strength. Straight-through ports assure streamlined flow. Every detail developed to give dependable, durable service. For steam pressures up to 125 pounds; 200 pounds cold. Patterns for every need. See Crane Catalog, page 101.*

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# CRANE

**FOR EVERY PIPING SYSTEM**

# PULVERIZING IN THE HIGH FINENESS RANGE

THE Raymond Vertical Mill is designed for producing extremely fine powdered materials . . . beyond the limits of the ordinary mill.

•

It operates in the lower micron range with no material left on 325-mesh. Where an average commercial mill may reach to a fineness of 99% passing 325-mesh at the fine end, the Vertical Mill goes from there upward to particle sizes as small as 99% finer than 5 to 10 microns *at the fine end*, depending on the kind of material being pulverized.

•

It is suitable for pulverizing medium soft non-metallic minerals, chemicals and similar materials, which will readily reduce by attrition to the smaller particle sizes.

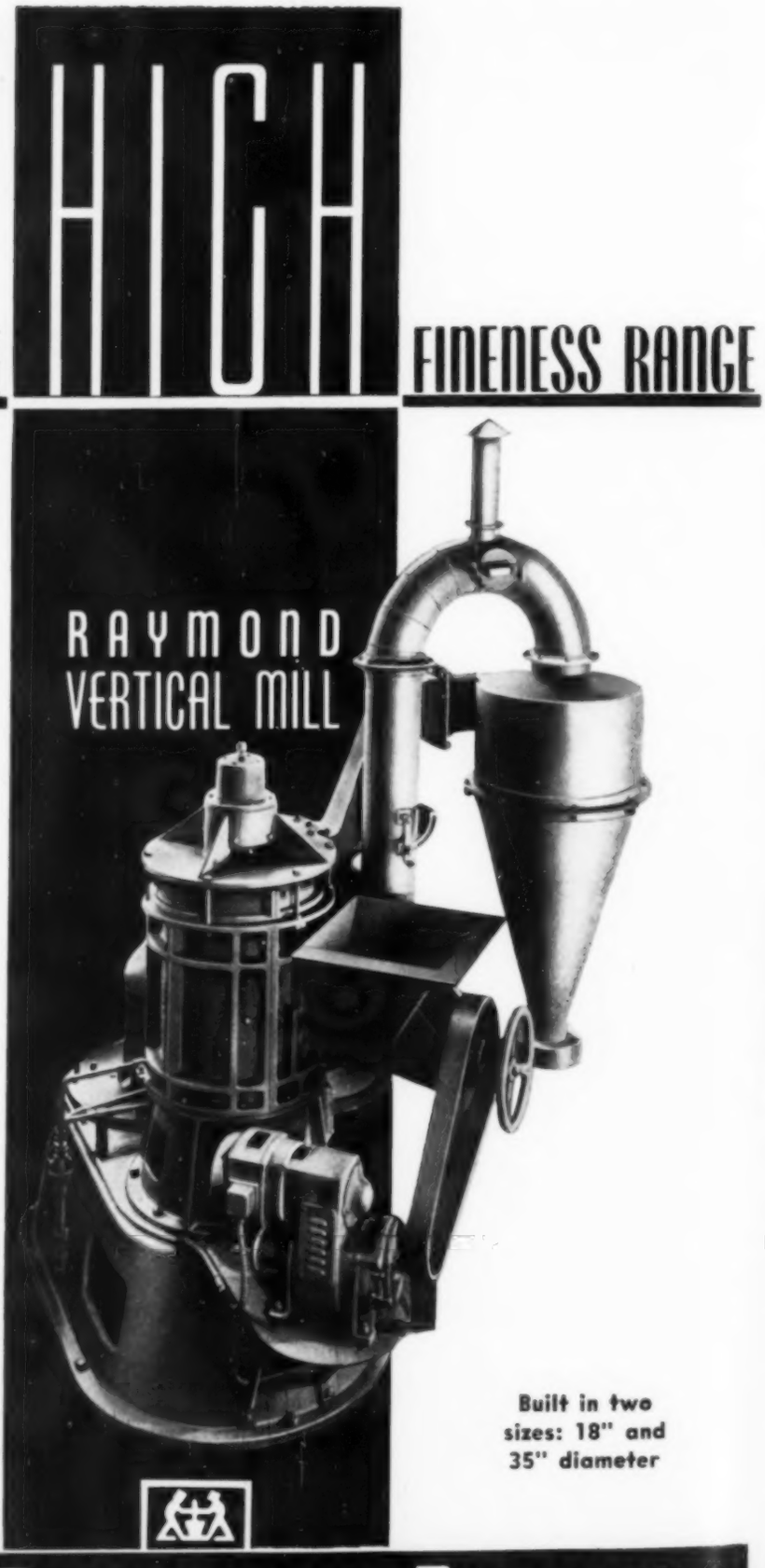
•

The superfine grinding of graphite to make lead pencils . . . reducing and mixing various pigments for water colors . . . pulverizing a chlorine chemical for a special product . . . producing impalpable talc powders . . . these are typical applications of the Raymond Vertical Mill.

•

This new principle in grinding for achieving new standards in production may offer a solution to your special problem.

***Write for VERTICAL MILL Bulletin #57.***




**Built in two sizes: 18" and 35" diameter**

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Sales Offices in Principal Cities • • • In Canada: Combustion Engineering Corporation, Ltd., Montreal

# NEW PRODUCTS AND MATERIALS

R. W. PORTER, Assistant Editor

## TRANSLUCENT LACQUER

A NEW FINISH for automobile bodies has recently been announced by the E. I. du-Pont de Nemours & Co. Inc., Wilmington, Del. Known as Duco Metalli-Chrome nitrocellulose lacquer, this new material is said to have greater durability, richer colors, and more translucency than heretofore possible. This new finish is claimed to be considerably better than the metallic colors of the past in which aluminum particles added to the lacquer mixtures provided a subdued sparkle. The metallic chromes are made by a patented method.

Pigment particles as they come from the grinder are very fine but do not remain that way. When they are dried, they tend to agglomerate so that when they go into suspension in the carrying vehicle they have grown considerably. In the past, this has eliminated any chance of light penetration between the particles and reflection back from the base surface. The new method used in making metallic lacquer depends on the method for transferring the wet pigment particles direct from grinding to the lacquer and at the same time removing all traces of water. In this way calcining is eliminated. When the pigment is sprayed onto the metal surface and the vehicle solution evaporates, there is left on the surface a microscopically divided finish through which light penetrates and reflects back giving a translucent effect.

The metallic chrome finishes embody a new pigment material, ferric hydroxide. While this has been used for many years for manufacturing iron oxide pigments, it has never been used as a pigment itself. It has been possible to use ferric hydroxide by means of first removing it from the water in which it is precipitated and then transferring it to a lacquer vehicle without drying it. Along with the ferric hydroxide, aluminum flakes are employed to give the mirror effect in this lacquer. While nitrocellulose lacquer not covered by an opaque pigment fail rapidly under sunlight, tests have shown that the new metallic chromes which are not opaque wear longer than the earlier lacquers developed for automobile use. It is expected that this new finish will cost considerably more than standard finishes.

## MILDEW-PROOFING AGENT

MARKETED under the brand name of Nuocides, a new line of fungicide concentrates is now available from the Nuodex Products Co., Inc., 743 Magnoila Ave., Elizabeth, N. J. Nuocides are solutions of liquid emulsion bases designed for controlling mildew or rot in textiles, lumber, paints, cordage and other similar products. They are usually applied to these products during processing operations. They can be processed without heating into ready-to-use preservatives or added in chemical processing. A good degree of resistance to mildew and rotting can be obtained from treatment with the different Nuocides which include both solvent and water soluble preparations. These fungicides include materials which are microbiostatic in that they arrest or inhibit microbial growth; others are microbiocidal in that they destroy micro-organisms. This material is claimed to impart longer life and mildew resistance to the fabric backing and finished coatings of oilcloth, artificial leather, rubberized fabrics, resin-coated fabrics, and other similar materials. Rope may be made from low-grade fibers which when thus treated are satisfactory for many purposes. Threads and fabrics from cotton, linen and rayon yarns may be protected from mildew and mold during and after processing. Various adhesives can be made mold-resistant with these fungicides. Casein and non-casein plastics have been protected against mildew growth, and rotting of wood in its various forms may be prevented.

## WHITE CARBON BLACK

UNDER development for over ten years, a fumed silicate has been produced in experimental quantities by the B. F. Goodrich Co., Akron, Ohio. Fumed silica is used in the manufacture of rubber products in the same manner as carbon black. This new white carbon black is a product of sand and alcohol. Ethyl silicate, a volatile liquid chemically combined from sand and alcohol is burned, resulting in a white soot. The superfine white partly translucent powder looks and acts entirely unlike the plain sand from which it is derived although it has the same chemical formula. Under an electron microscope, the superfine translucent powder is made up of particles that have the same size and shape as carbon black, and performs exactly in the same way, giving rubber compounds added tear resistance, abrasion resistance and tensile strength without affecting the color or translucency.

Use of carbon black has prevented the manufacture of many colored rubber products since even a tiny percentage of carbon black, a product of imperfect combustion of waste natural gas, in a rubber compound makes it impossible to achieve white or light colored end products. By using the new silica powder, not only white, but all other colors will be possible without any difficulty. By substituting the fumed silicate for carbon black, a rubber tire emerges from the mold with a light gray color. This will enable the manufacturer to turn out casings in any color desired with both the tread and side walls the same color. Test tires are being made with this material. Practically any other coloring material can be added to make various colored rubber products which were impossible when carbon black was used. Commercial utilization of this compound is still not practical because of its present high cost in relation to carbon black. To date production has been on a pilot plant basis only.

## CONTENTS



## SYNTHETIC AMINO ACID

ONE OF the ten amino acids considered essential for the growth of man and animals, methionine has been synthetized by a new commercial process by the U. S. Industrial Chemicals, Inc., 60 East 42nd St., New York 17, N. Y. Having the formula $C_5H_{11}NO_2S$ it is also known as 2-amino-4-methylthiobutanoic acid. This material has previously been available only in minute quantities and at a cost of several hundred dollars per pound. It is expected that the new process will reduce the cost about 97 percent to make methionine available for the number of important medical uses which are already known, and for others now under study. It is said to be particularly valuable in treatment of liver disorders.

As one of the essential amino acids, methionine is an exogeneous substance which cannot be synthesized by the human or animal body and consequently must be in-

corporated in the diet. It is present in various proteins and the best source is milk and dairy products such as cheese. One quart of milk contains about 1 g. of methionine.

Certain liver diseases, such as acute necrosis, and chronic cirrhosis, are brought about by insufficient intake of methionine. Methionine is claimed to be valuable in the treatment of burns, shocks, exposure, and acute surgical conditions. Although the best natural sources of methionine are dairy products, fish and liver, therapeutic doses of natural methionine would call for an abnormally large food intake. For example, four to ten quarts of milk per day would be required for a therapeutic dose while a few grams of the new synthetic product will produce the same effect. Experimental quantities of this substance have been produced in the past from organs of sheep and cattle, and by high-cost, small-scale laboratory processes. The new synthetic, now in commercial manufacture, is being supplied only to drug and pharmaceutical manufacturers.

## ANTI-SLIP COATING

ADDITION of a new product to its line of industrial coatings has been announced by the Flintkote Co., 30 Rockefeller Plaza, New York 20, N. Y. Under the brand name of Flintred this new product consists of a synthetic plastic anti-slip coating which is applied by trowel over steel, concrete, aluminum, galvanized iron, hard tile and wood floors. On clean steel it serves as a corrosion resistant protective coating in addition to its function of overcoming slipperiness. It is resistant to water, gasoline, oil, alcohol, and ordinary fats and greases. Flintred will be available in red, green and slate blue, and is usually applied in coats of approximately $\frac{1}{16}$ to $\frac{1}{8}$ in. in thickness.

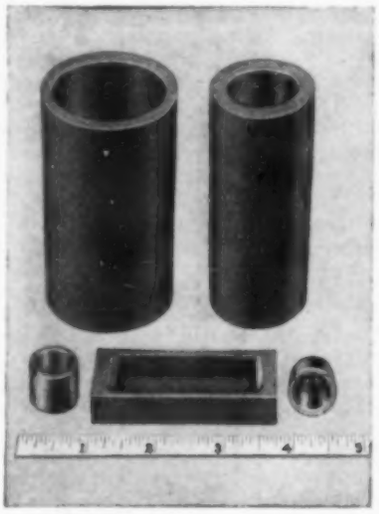
This new coating is not a paint. It is a synthetic plastic material incorporating a mineral type filler which imparts toughness to meet wear and tractive resistance against slipperiness when wet. While it is flammable in liquid form, when it has hardened after application it is non-flammable to the degree that it will not support combustion. It should be stored and applied at temperatures within the temperature range of 50 to 100 deg. F. It is available in 5 gal. containers and its coverage varies with the type of surface on which it is used. It is recommended for use around machinery, on steps and ladder treads, on ramps and platforms, on steel decks and floors, and on areas that become unsafe underfoot when wet from water, oil or similar materials.

## PEANUT FIBER

PROTEIN fiber made from peanuts has been recently announced by the Southern Regional Research Laboratory, U. S. Department of Agriculture, New Orleans, La. This new fiber has been developed through all stages of textile manufacture, including knitting and twisting. In producing the fiber, protein is removed from peanut meal by an alkaline solution after the raw peanut meal has been bleached. The meal residue after the protein fiber is removed still contains enough protein to be valuable as livestock feed. This new fiber is similar to Ardil developed by the Imperial Chemical Industries in England. The fiber, which makes a fabric similar to wool, is not yet in commercial manufacture.

## TUNGSTEN SHAPES

ATTRACTIVE for many applications because of its high melting point of 6,100 deg. F., tungsten metal is nevertheless difficult to form into the shapes required and must be worked by the methods of powder metallurgy. Kennametal Inc., Latrobe, Pa., has



Large tungsten shapes formed by powder metallurgy

recently applied methods developed in the manufacture of cemented carbide compositions to the forming of tungsten shapes such as large crucibles and boats for the high temperature melting of refractory materials and high melting metals.

An indication of the size of objects that can be formed in this way is shown in the accompanying view, the largest crucible being $1\frac{1}{2}$ in. inside diameter by 3 in. deep and weighing in excess of 2 lb. Considerably larger sizes, up to about 3 in. in diameter and about 10 lb. in weight, are possible. Virtually all shapes may be made of a very pure grade tungsten without a binder. The strength is sufficient for most purposes, but does not compare with that for worked tungsten. However, improvement in strength can be made by alloying with tantalum or other metals, which can be done in the procedure used. A little porosity results, and this, too, can be reduced by certain alloying additions where necessary. Tungsten, being readily oxidized at elevated temperatures, must be used only in a vacuum or in heating equipment which provides inert or reducing atmospheres.

## THERMOPLASTIC RESINS

MANUFACTURED for military purposes during the war, a new series of resins under the trade name of Kendex is now being manufactured by the Kendall Refining Co., Bradford, Pa. These resins were not available before the war, although their development goes back further than that. The Kendex resins range from hard brittle substances to tough rubbery products with some of the characteristics of elastomers. The surface and feel may be waxy, tacky, or hard and mar-resistant. All of these products are characterized by their dark color which ranges from a brownish black to jet black. Some are claimed to be outstanding in the hydrocarbon resin field because of the relatively small variation in physical properties caused by temperatures changes. They are all produced from petroleum. Suggested uses for the various Kendex resins include the following: laminants, adhesives or binders, rubber extenders asd plasticizers, mastic binders, baking varnishes, pipe coatings, polishers, casting waxes, sealing compounds, water resistant coating compounds and many others. These resins are all thermoplastic and may be applied hot or by many of the usual methods such as hot melt dipping or saturating, doctoring, spraying, roll coating, extruding, etc. The flash and fire points of all the Kendex resins are well into the safe working range for hot application. Some of these resins may be emulsified and they all may be handled cold as liquids by blending with various solvents. They are marketed in 100-lb. non-returnable fiber containers or in 350-lb. drums.

## ROSIN SOAP

ONE OF a family of rosin soaps developed by the Hercules Powder Co., Wilmington, Del., is now finding many civilian uses. Dresinate 731, the sodium soap of a disproportionated pale wood rosin, replaced fatty acid soap during the war in the production of synthetic rubber. It is a pale-colored paste, having a total solids content of 64 percent, and an acid number of 12. Its viscosity is sufficiently low to enable it to be handled in drums and tanks. Dresinate 731 is used as an emulsifier in high solids latices and in other emulsion polymerization systems utilizing monomers other than butadiene and styrene. It has been used successfully in the emulsion copolymerization of butadiene and acrylonitrile, isoprene and styrene, and in the polymerization of styrene, methyl methacrylate and butadiene. Tests have shown that GR-S-10 compounded stocks possess higher tensile strength, greater elongation, superior tear resistance, better flex-cut growth, when Dresinate 731 is used in place of fatty acid soaps.

## RUBBER CHEMICALS

FULL-SCALE production of the first of a series of rubber chemicals known as Darex Copolymers has recently been announced by the Dewey & Almy Chemical Co., Cambridge, Mass. Darex Copolymers Nos. 2 and 3 have been evaluated both in the laboratory and in small-scale commercial plants. They have proved to be good processing aids and compounding ingredients and are claimed to improve the following qualities in various products: Abrasion resistance and flexibility in GR-S and natural rubber shoe soles and top lifts; hardness and tensile strength in molded semi-hard rubber elec-

# PFAUDLER PILOT PLANT KETTLES ANSWER SUCH QUESTIONS AS THESE

**At what temperature is yield at a maximum?**

**What is the effect of pressure on yield and reaction time?**

**What is the most economical batch?**

**What is the optimum agitator speed?**

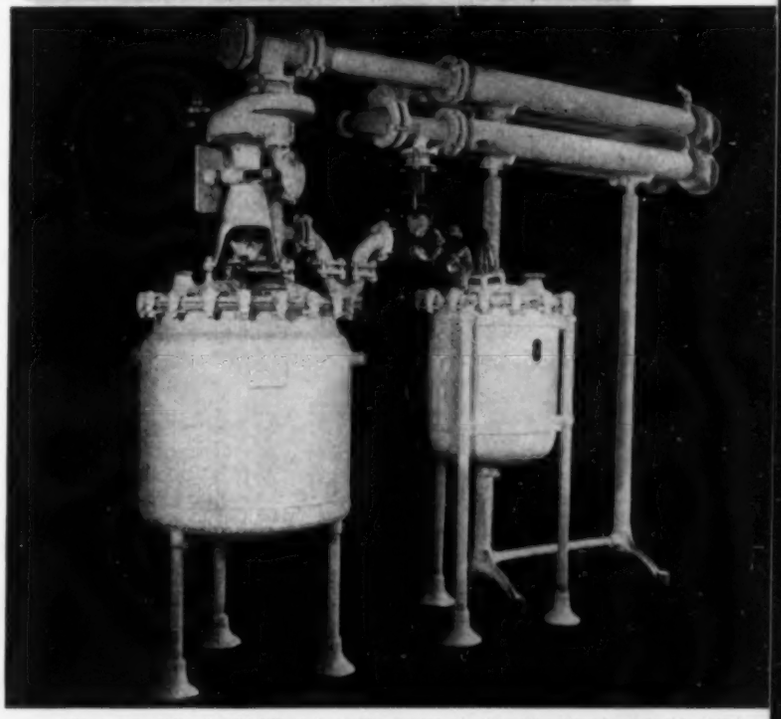
It is an axiom of the Chemical Industry to "make all your mistakes on a small scale and all your profits on large scale." Safe procedure calls for one more step, the pilot plant. Standard Pfaudler acid-resisting glass-lined steel pilot plant kettles are made exactly for this purpose.

You transfer operations from glass flask and beaker to glass-lined steel. You simulate exact conditions for both the laboratory and the factory. You get the answers to questions like those indicated above at small cost before transferring operations to full-scale production.

These units also have proved invaluable where small quantities of rare or expensive products are involved. In such cases, they are used as production units on a permanent basis . . . with safety and efficiency.

## CAPACITY RANGE GIVES YOU WIDE SELECTION

There are 24 Pfaudler Pilot Plant Kettle combinations. All units are resistant to all acids (except H.F.) at elevated temperatures and pressures. With capacities of 5, 10, 20, 30, 50, and 100 gallons, any kettle is available with or without steam jacket, top-head, agitator and motor drive. You can select the right combination for your particular requirements. Such flexibility is basic with standard Pfaudler glass-lined process equipment. You get the benefit of reduced cost, at the same time securing almost a custom-built job. May we send you further information?



**This standard Pfaudler Pilot Plant Assembly consists of a 50-gallon glass-lined steel-jacketed still, a glass-lined steel return bend condenser, a 30-gallon glass-lined steel receiver, all connected with standard glass-lined pipe, fittings and valves.**

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**THE PFAUDLER CO., ROCHESTER 4, NEW YORK**

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trical and automotive parts; dielectric strength and moisture resistance in GR-S, GR-I, and GR-M wires insulation; rate of extrusion and movement in thin-walled GR-S tubing and Neoprene hose. Tests indicate possibilities for improving feel and embossing characteristics of coated fabrics and artificial leather, for increasing resilience and toughness of hard rubber; buna grinding wheels and molded plastics; for imparting good chemical and moisture resistance to rubber resin base paints and paper coatings; for improving wearability and color possibilities in rubber tile and flooring. They also show promise for use in such products as tennis balls, hot water bottles, typewriter rolls, and erasers. As processing aid in extruded hose and wire installations, Darex copolymers impart smoothness to gum rubber stocks without reducing the apparent rubber content; in calendered and spread goods, smoother, glossier surfaces are secured; and in molded goods they increase the ease of flow and reduce mold shrinkage. GR-S, buna-N. butyl, and Neoprene syn- They are compatible with natural rubber, thetic rubbers and with various types of plastics. They may be milled, extruded, calendered, compression and injection-molded in regular rubber and plastic equipment.

### ALKYLAMINE

NOW AVAILABLE in experimental quantities from the Commercial Solvents Corp., 17 East 42nd St., New York, N. Y., Diisopropylamine is similar to other secondary amines. It has a boiling point of 83.7 deg. C., and for this reason can be conveniently used with less loss of volatile material than is the case when lower secondary amines are employed. It has a freezing point of below —60 deg. C., and is partially miscible with water and completely miscible with most organic solvents. Diisopropylamine is suggested as a starting material for the synthesis of a variety of products such as textile specialties, detergents, inhibitors, dyes, pharmaceuticals, and other similar products.

### SYNTHETIC DETERGENT

INTRODUCED recently by the Alrose Chemical Co., 180 Mill St., Cranston, R. I., a new dry synthetic detergent is claimed to have good possibilities for household and textile use. The active ingredient of this material, which is known as Alrosene PD, is a modified alcohol sulphate. It contains 15 percent active ingredients, 85 percent inorganic salts; a 1 percent solution has a surface tension of 30.5 dynes per centimeter at 25 deg. C. Alrosene is a white, odorless, noncaking, non-dusting, dense powder and is soluble in cold water yielding opalescent, soaplike solution at 1 percent concentration. At temperatures higher than 35 deg. C., the solution is colorless and transparent. It is stable in storage and in acid or alkaline solutions; Alrosene PD exhibits good detergency on both wool and cotton in neutral solutions. Cleaning efficiency is claimed to improve with increasing temperature with no redeposit of soil on long exposure. It is also claimed to be a better detergent in hard water than in soft water and may be used with alkalies such as phosphates, silicates, bicarbonate, borax, and with high concentrations of neutral salts to improve

detergencies. It retains considerable activity in dilute acetic acid which may be used where there is danger of colors running. A 1 percent solution of Alrosene PD at 45 deg. C. produces six volumes of foam upon agitating. Foam draining is slow and stability is good. It is unaffected by 550 ppm calcium chloride hardness. This new detergent may be used for various industrial applications and for laundering, upholstering and rug cleaning, general household cleaning, etc. It may be mixed with soap powder, other synthetic detergents, alkalies, neutral salts, and proteins.

### ETHYL SILICATE

COMMERCIAL quantities of ethyl silicate 40 are now available from the Carbide & Carbon Chemical Corp., 30 East 42nd St., New York 17, N. Y. Ethyl silicate 40 is a new condensation product containing approximately 40 percent available silica. It is a light brown, mild odored liquid and undergoes the hydrolysis and subsequent dehydration characteristic of pure tetraethyl orthosilicate. It is claimed to deposit silica at lower cost than other ethyl silicates. This new polymer, which is a convenient source of adhesive silica, is suggested for use as a refractory particle binder, for weatherproofing stonework, for formulating special heat-resistant surface coatings, and may also be used for gelling such liquids as acetone, ethanol, and isopropanol to make solid fuels.

### ALUMINUM FINISHES

Now AVAILABLE for civilian use, nine types of aluminum protective coatings designated as the Alumcote series has been announced by the Watson-Standard Co., Pittsburgh 12, Pa. Incorporating a number of improvements developed during the war, these coatings have been designated to specific requirements. They are claimed to make possible smoother, more brilliant and more durable product finishes. Coatings in this series are recommended for use in a number of different applications in various fields. An Alumcote finish for black plate should be of interest to container manufacturers, metal fabricators and to lithographers. A heat-resistant coating is available for reflectors, stoves and heaters. Smooth, tough and brilliant coatings have been formulated to withstand abrasion and severe handling and are said to be useful in various types of toys. Paper converters, too, are expected to find Alumcote suitable for producing embossed, decorative and protective food packing products.

### SYNTHETIC CRYSTAL

PROMISING to have wide application in petroleum refining, synthetic rubber production, and in other industries where the use of infrared rays are, or can be, used to advantage in manufacturing controls, a new synthetic crystal made of silver chloride is now commercially available from the Harshaw Chemical Co., 1945 E. 97th St., Cleveland, Ohio. Ordinarily light rays pass through samples of hydrocarbon without change. However, infrared or ultraviolet rays are stopped or obstructed by some of the material. When such obstructions occur, a shadow is cast and such shadows are recorded

on a graph or wave line. The amount of foreign matter can then be readily determined by an experienced operator on the spectroscopic machine. The new silver chloride crystal is said to be valuable in this type of analytical equipment. Silver chloride crystals can be grown in eight days, can then be rolled, pressed, stamped or cut into any shape or thickness desired, after which they require no polishing.

### MERCERIZING ASSISTANT

ANOTHER of the Dypenol series of mercerizing assistants under the brand name of Dypenol SED has been announced by the Dexter Chemical Corp., 819 Edgewater Road, New York, N. Y. This chemical is added directly to the mercerizing caustic and is said to eliminate preliminary boiling out of the yarn or fabric. This mercerizing assistant is also claimed to permit higher mercerizing speeds without decrease in the degree of mercerization. It has good wetting speed and does not lose its power through exhaustion onto the goods nor on standing in the caustic. Dypenol SED is recommended for use in caustic soda solutions ranging in strength from 48 deg. Tw. to 58 deg. Tw.

### CLEANER

DEVELOPED and tested by the Ethyl Corp., Detroit, Mich., a new multi-purpose household cleaner and car wash is now available. Consisting of a synthetic detergent derived from petroleum, it contains no animal or vegetable fats, greases, acids or strong alkali. It is sold in the concentrated liquid form to be diluted with water. Ethyl cleaner is recommended for various home uses including cleaning painted walls and woodwork, enameled and porcelain finishes, tile, windows, refrigerators, stoves, upholstery and rugs, and for washing fine woolens. It is effective in cleaning all surfaces of an automobile including the body, windshield and windows, chromeware, upholstery, tires, etc. It leaves no soapy film and suds readily in any kind of water; hard, soft, or even sea water. It is available from grocery, drug, hardware and automotive accessory wholesalers, department stores and oil companies in four convenient quantities: 6 oz., 16 oz., 24 oz., and 32 oz.

### NITROCELLULOSE COATING

DANGER of bottle breakage can be obviated, it is claimed, through the use of a tough nitrocellulose plastic coating which serves as a protective armor around a glass bottle and holds its shape, even though the glass underneath is shattered. Protected bottles of this type have been developed by the Detroit Macoid Corp., Detroit, Mich., according to Hercules Powder Co., Wilmington, Del. At the present time 1-gal. bottles are being coated in this fashion with a solution based on Hercules nitrocellulose. An even film of 20-25 thousands of an inch is secured by a dipping operation.

### PLASTIC DYE

A NEW coloring material known as Kriegr-O-Dip Universal dye for use with several types of plastics has been announced by the Krieger Color and Chemical Co., 6531 Santa Monica Blvd., Hollywood 38, Calif. It is available in several colors.

# CHEMICAL ENGINEERING NEWS

## FIRST MEETING OF CHEMICAL WARFARE ASSOCIATION

First annual meeting of the recently formed Chemical Warfare Association was held at Edgewood Arsenal, Md., on May 24-25. Because of transportation difficulties, some of the speakers who were scheduled to address the meeting were unable to be present. Maj. Gen. Alden H. Waitt, chief of the Chemical Warfare Service spoke on "Postwar Plans for Chemical Warfare Service." Dr. W. A. Noyes, president-elect of the American Chemical Society discussed "Chemical Research and Developments in World War II" and Lt. Gen. J. Lawton Collins, director of information of the War Department, presented an address on "Major Lessons of World War II." Dr. Noyes' paper was read by T. H. Marshall.

The New York Chapter of the Chemical Warfare Association held its first meeting early in May and formally organized by electing the following officers: Charles H. Minor, Taylor-Wharton Iron & Steel Corp., president; S. W. Jacobs, Niagara Alkali Co., vice president; Jerome F. McGinty, Millmaster Chemical Co., secretary; and Marvin J. Silberman, Royal Lace Paper Co., treasurer.

## RADIOACTIVE ISOTOPES TO BE MADE AVAILABLE

Details of a program for the nationwide distribution of beneficial radioactive isotopes to be produced from the uranium chain-reacting "atom pile" of the Clinton Laboratories at Oak Ridge, were announced on June 14. The isotopes to be made available will be used in research work in pure and applied sciences.

Distribution will be coordinated and supervised by an advisory committee on isotope distribution policy, members of which were appointed by Maj. Gen. L. R. Groves, Chief of the Manhattan Engineer District, on recommendation and nomination by the National Academy of Sciences.

Only qualified institutions such as recognized research laboratories including industrial research laboratories, hospitals, universities, and clinical investigation groups will be able to obtain the radioactive material. All groups using these isotopes for fundamental research or applied science will be required to publish their findings.

## CHINESE ENGINEERS WILL HOLD CONVENTION

Third annual convention, since its revival in 1942, of the Chinese Institute of Engineers, America Section, will open at the Hotel New Yorker, New York, on June 29 and continue through July 1. Membership of the section now exceeds 1,000 scattered throughout the United States. The program includes a business meeting, technical sessions, plant visits, and the annual banquet. During the technical sessions there will be talks by leading Chinese and American engineers who recently returned from technical missions to Taiwan and other parts of China. Group visits will be conducted to industrial and utility plants in and around New York.

Dr. P. H. Chang, new Chinese Consul-General in New York and official spokesman for the Chinese Government in Chungking during the war years, will be the main speaker at the banquet which will be held on the evening of July 1.

## DUPONT TO HAVE PLASTICS PLANT IN WEST VIRGINIA

About the middle of May it was announced that within a month construction would start on a new plastic plant for E. I. du Pont de Nemours & Co. at Washington Bottom, near Parkersburg, W. Va. Arnold E. Pitcher, general manager of the plastics department said the new plant will manufacture Lucite acrylic resin and polythene molding powder. A new unit also will be afforded for the production of nylon bristles and molding powder. Construction has been approved by the Civilian Production Administration and the construction division of du Pont's engineering department will be in charge of the work. Temporary offices were established on May 15 in a former home on the 400-acre plant site.

## THE GEORGE WESTINGHOUSE CENTENNIAL FORUM

Sponsored by the Westinghouse Educational Foundation in commemoration of the 100th anniversary of the birth of George Westinghouse, noted inventor and industrial pioneer, a three-day forum was held at Pittsburgh on May 16-18, with the role of science in advancing civilization as the keynote. The occasion brought together many of the men responsible for major wartime scientific advances.

At the luncheon on May 16, Gwilym A. Price, president of the Westinghouse Electric Corp. and treasurer of the Westinghouse Educational Foundation, emphasized the necessity for preventing another war. He said the instruments, technics, and theories, developed for purposes of destruction, have given us a new wealth and a new challenge. He referred to the awesome power we now have for destruction as awakening us to a new realization of the impact of science on our affairs. In return for our new-found wealth we are forced to assume new and critical responsibilities. We must view the bewildering number of forces and agencies we have with conviction and faith and shape them to good purpose.

L. W. Chubb, director of the Westinghouse research laboratories, urged that scientific knowledge be applied so that more people may benefit by it more quickly. He pointed out that the more rapid unfolding of the secrets of nature, the encouragement given to scientific pursuits and especially the technical accomplishments during the war have shown more than ever before the great influence of science on our national welfare. He further pointed out that although the war has been described as a scientists' war, actually science alone could not have brought victory as it was the combination of scientific knowledge and industrial know-how that spelled superiority over the Axis.

One of the most important sessions was given over to a symposium on "The Future of Atomic Energy." Foremost authorities on atomic research joined in predicting a brilliant peacetime future for this new source of energy in the generation of electricity, in

**Dr. J. Robert Oppenheimer, professor of physics, University of California, and director of the laboratory at Los Alamos, N. Mex., where the atomic bomb was perfected, addressing the George Washington Centennial Forum at Pittsburgh**

medicine, biology and chemistry, providing an effective international control can be set up to regulate the manufacture of bombs.

Dr. J. Robert Oppenheimer, professor of physics, University of California, who directed the special laboratory at Los Alamos, N. Mex., where the atomic bomb was perfected, reviewed suggestions already advanced for international control of atomic energy and expressed the belief that much might be accomplished through world government with international law applying to the citizens of nations as federal law does to those of states.

Dr. Enrico Fermi, professor of physics, University of Chicago, brought up the possibilities of atomic energy as a source for the generation of power. He said we might conceive that 20 or 30 years from now the general scheme of atomic energy production may be perhaps as follows. There will be large central installations in which very great amounts of power will be produced and transformed into electricity energy or steam for local power consumption. Besides directly producing power, these large units also may produce some plutonium which will be extracted and distributed to small installations in which plutonium and not uranium will be used as the primary fuel. This plan would have the advantage of permitting wide use of relatively small power units thereby reducing the difficulties of distribution.

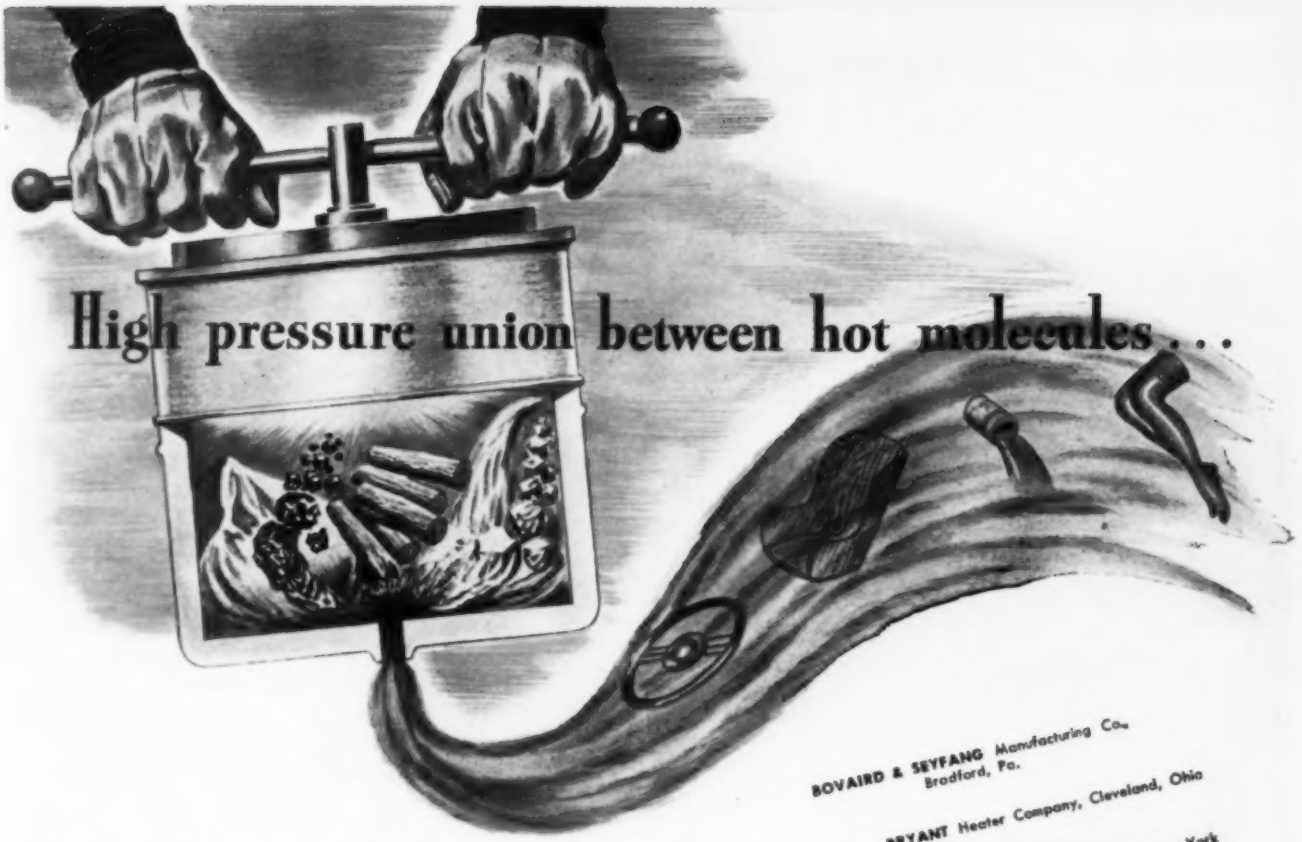
Dr. Hugh S. Taylor, dean of the Graduate School, Princeton University, spoke on the chemical aspects of atomic research. He placed much value on the tracer technics which, through the use of radioactive substances, enable the scientist to speed up analytical processes. He declared this will be particularly valuable in the fields of metallurgy and metallography and also in operations where problems of fluid flow must be solved. He suggested that we should go back to our fundamentals of inorganic and organic chemistry to ascertain whether, with the newer reagents now available on large technical scale, we cannot devise new approaches to old objectives.

Discussing the biological phase of atomic energy Dr. W. Edward Chamberlain, professor of roentgenology and radiology, Temple University, said the new science of atomic energy will benefit biology and medicine not only directly, as when radioactive isotopes from cyclotron, betatron or chain-reaction-pile are put to work as tracers, or as therapeutic agents but indirectly, through the spectacular advances which it has produced and will continue to produce in all scientific thinking.

## MONSANTO GRANTS ACADEMIC LEAVE TO SCIENTISTS

INAUGURATION of an academic leave for the technical personnel of Monsanto Chemical Co. to enable them to return to universities of their choice for an academic year of study at full salary, was announced in New York last month by Dr. Carroll A. Hochwalt of Dayton, Monsanto's director of central research.

Addressing the National Industrial Conference Board, Dr. Hochwalt said the leave of absence was established to encourage the scientific work and development of technical personnel in physics, chemistry and chemical engineering. Four leaves will be



# High pressure union between hot molecules . . .

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Chemists have learned to mix the unmixables. It wasn't so only a generation ago. Solids and liquids and gases which formerly remained strictly aloof from each other, today can be united under high pressure and heat.

They produce a myriad of low-cost miracles. The lustrous yet washable gowns; the beautifully stockinged leg; brilliant plastics; weed killers; quick drying paints; fireproof lumber—all are facts of life grandma didn't know about. All are results of high pressuring molecules.

Members of Dresser Industries engineer high-pressure equipment for this large scale chemistry. Pumps that push these hot mixtures around under hundreds of pounds pressure per square inch. Compressors that squeeze chemical activity into the more reluctant substances at 5000 pounds pressure. Storage tanks that hold half a million cubic feet of temperamental gas ready and waiting under a tight lid at 100 pounds to the square inch.

But the compressors and pumps and vessels are themselves made of elements which tend to unite chemically with the contents under heat and pressure. Licking corrosion in high-pressure equipment has been one of Dresser Industries' contributions to lower-cost luxury. As chemistry thinks up new problems, Dresser Industries, Inc., creates the equipment that is *First to Be New—Last to Wear Out.*

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**PAYNE** Furnace Co., Beverly Hills, Calif.

**SECURITY** Engineering Co., Inc., Whittier, Calif.

**KOBE**, Inc., Huntington Park, Calif.

**PACIFIC** Pumps, Inc., Huntington Park, Calif.

**ROOTS-CONNERSVILLE** Blower Corporation, Connersville, Ind.

**STACEY BROS.** Gas Construction Company, Cincinnati, Ohio

**VAN DER HORST** Corporation of America, Olean, N. Y. and Cleveland, Ohio

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granted each year and will be made on the basis of especially meritorious service and outstanding performance in scientific work carried out at any period and in any location in the service of Monsanto. The recipients will return to campuses of their own choosing for refresher courses and original research.

## FIBER DRUM INDUSTRY FORMS TRADE ASSOCIATION

FOLLOWING preliminary meetings held in New York in February and March, members of the fiber drum industry recently met in Cleveland and formally completed the organization of a trade association. Officers elected were: H. L. Carpenter, president Carpenter Container Corp., Brooklyn, president; W. J. Mahoney, president, Master Package Corp., Owen, Wisc., vice president; Glenn Mather, the container company division, Continental Can Co., Inc., Van Wert, Ohio, secretary; and R. C. Carlson, president, Emery-Carptenter Container Co., Cincinnati, treasurer.

## CONFERENCE OF CHEMICAL INSTITUTE OF CANADA

HOLDING its annual conference at the Royal York Hotel, Toronto, on June 24-26, The Chemical Institute of Canada has arranged technical sessions devoted to biochemistry, chemical education, chemical engineering, protective coatings, pure chemistry, rubber and textiles. A symposium on conservation will be held dealing with soils, wild life and water courses, and forestry.

Chemical equipment, apparatus, products and appliances will be exhibited by approximately 45 leading manufacturers and sup-

## CONVENTION CALENDAR

**Chemical Institute of Canada, annual conference, Royal York Hotel, Toronto, Ont., Canada, June 24-26.**

**American Society for Testing Materials, annual meeting, Hotel Statler, Buffalo, N. Y., June 24-28.**

**American Institute of Chemical Engineers, regional meeting, Palace Hotel, San Francisco, Calif., August 25-28.**

**American Chemical Society, 110th meeting, Chicago, Ill., September 9-13.**

**Fourth National Chemical Exposition, Chicago, Ill., September 10-14.**

**Instrument Society of America, first national conference and exhibit, William Penn Hotel, Pittsburgh, Pa., September 16-20.**

**The Electrochemical Society, Inc., fall meeting, Hotel Royal York, Toronto, Canada, October 16-19.**

**Federation of Paint and Varnish Production Clubs, annual convention and paint industries show, Hotel Claridge, Atlantic City, N. J., November 4-6.**

**National Paint, Varnish & Lacquer Association, annual convention, Atlantic City, N. J., November 6-8.**

pliers. The American Chemical Society exhibit on atomic energy also will be on display.

Special speakers at the general sessions and dinners will include Hon. George Drew, Premier of Canada; Dr. E. H. Land, Polaroid Corp.; W. S. Richardson, B. F. Goodrich Chemical Co.; Dr. A. L. Washburn, Arctic Institute of North America; Dr. E. C. Williams, Schenley Distillers Corp.

Non-technical talks and movies on plastics, synthetic fibers, foods, laundering practices, etc., are arranged for the ladies in addition to separate entertainment and social functions. The annual dinner on June 25 will be followed by a dance.

## STANDARD OF OHIO HOLDS TECHNICAL MEETING

THE successful character of a three-day technical meeting held last month in Hot Springs, Va. for discussion of current refinery, research and process control problems and developments has led The Standard Oil Co. (Ohio) to schedule annual meetings of this type for key members of its technical staff.

Sixty of the company's research and refinery engineers, chemists, refinery managers and manufacturing executives participated in the first of these sessions which was planned by E. B. McConnell, general manager of the manufacturing department. The program included presentation of a number of original papers by members of the Sohio staff on process, testing and research questions concerning operating methods and product development work.

G. W. Hanneken, vice president in charge of manufacturing, who addressed the opening dinner, pointed out that these conferences were conceived for the exchange of views, as well as to acquaint all key members of the technical staff with detailed developments in the more important aspects of refinery operation and control, product development and research.

## DOW CONSOLIDATES ALL MAGNESIUM OPERATIONS

CONSOLIDATION of magnesium operations of The Dow Chemical Co. under a separate executive board and general manager and the resumption of magnesium production at the company's sea water plant at Freeport, Texas, were announced simultaneously on May 17 by Dr. Willard H. Dow, president and general manager of the company who will act as chairman of the new executive board.

This brings the company's magnesium sales, fabrication and technical divisions together under the general managership of Dr. J. D. Hanawalt, former director of metallurgical research, and is expected to facilitate maximum coordination of effort. Production of magnesium ingot at the company's Texas plant, which has been closed since the end of the war, will be resumed as soon as possible and is expected to reach full capacity by midsummer.

Serving on the executive board of the magnesium division with Dr. Dow and Dr. Hanawalt will be G. F. Dressel, former production manager who is now assistant general manager, Dr. T. H. McConica III, former assistant technical director who is

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# Prevents Sludge and Rust

STOPPAGES of hydraulic mechanisms may occur at any time, and they generally come suddenly, with no apparent warning. Most stoppages are caused by: 1) *sludge,* due to oxidation of the hydraulic oil, and 2) *rust,* due to moisture that gets through ordinary oil film onto the metal parts. Rust is particularly likely to form during periods when the machine is idle.

*Texaco Regal Oils (R & O)* are strongly inhibited against both rust and oxidation. They stand up under high temperatures and agitation—preventing sludge formation. They "plate" the surfaces of valves, gears and other parts with a rust resisting film so that moisture does not reach metal surfaces. In addition, *Regal Oils (R & O)* will not foam. This means smooth, dependable operation.

*Texaco Regal Oils (R & O)* have proved themselves in service on all types of hydraulic units, from giant presses to small machine tools. One nationally famous user writes that they *". . . . have eliminated the difficulties formerly experienced with oil varnish in the hydraulic system."* Leading hydraulic equipment manufacturers use and recommend *Texaco Regal Oils (R & O).*

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### FOR ALL HYDRAULIC UNITS

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now technical assistant to the general manager; H. Freuhauf, former manager of the Bay City, Mich., foundry and fabrication plant, who has been named production manager; L. B. Grant, who continues in the capacity of sales manager; and C. E. Nelson, former assistant technical director who is advanced to technical director.

### STANDARD OF INDIANA WILL CONSOLIDATE REFINERIES

WARTIME technological developments in petroleum refining have forced the Standard Oil Co. (Indiana) to a decision to close its refineries at Neodesha, Kas., and Greybull, Wyo., and consolidate operations with those of other Standard refineries.

The decision will become effective about two and a half years hence at Neodesha and about two years hence at Greybull. Installation of catalytic cracking equipment during the war, the company explained, has developed a competitive situation that would require such equipment to be installed at these two refineries as well as at other Standard refineries not far from each of the two. Engineering studies showed that this duplication would be uneconomic and compelled the decision to close the two plants.

Construction of catalytic crackers and related equipment has been decided upon for the Sugar Creek, Mo., refinery, near Kansas City, and the Casper refinery, in Wyoming. Negotiations will soon be opened with the unions at those plants to work out a basis for the transfer of Neodesha employees to such jobs as will be available at Sugar Creek and similarly for the transfer of Greybull employees to Casper.

### CHARLESTON SECTION AICHE HOLDS ANNUAL MEETING

ANNUAL meeting of the Charleston Section of the American Institute of Chemical Engineers was held at Charleston, W. Va., on May 16. R. F. Moran of Westvaco Chlorine Products Corp. was selected as chairman for the coming year. Other officers elected were F. A. Otto, E. I. du Pont de Nemours & Co., vice chairman; D. J. Porter, Westvaco Chlorine Products Corp., secretary; J. F. Roe, Monsanto Chemical Co., treasurer; and R. Voorhees, Carbide & Carbon Chemical Corp., member-at-large.

### INSTITUTE OF CHEMISTS ELECTS OFFICERS

AT ITS annual meeting held on May 17 at the Hotel Biltmore, New York, the American Institute of Chemists was informed by Dr. Gustav Egloff, retiring president, that membership in the Institute has continually increased to reach the all-time high of 2042. The establishment of a new chapter in New Jersey brings the total number of local active groups to 12. He expressed the regret of the members at the resignation of Howard S. Neiman as secretary, a position he ably filled for 20 years. The Gold Medal of the Institute was presented to Robert P. Russell of the Standard Oil Development Co.

Officers for the ensuing year were elected as follows: Dr. Foster D. Snell, president,

# TIME TAKES WINGS

## WHEN LIFE IS AT STAKE


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**MANUAL ARTIFICIAL RESPIRATION**

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The *first* essential in restoring breathing is to begin artificial respiration without delay—every second is vital.

With manual respiration begun, the second great essential is the prompt application of the H-H Inhalator—entering into the rhythm of the patient's respiration without the slightest break or pause, supplying, in quantity regulated automatically by individual lung demand, the stimulating mixture of oxygen-carbon dioxide necessary for rapid recovery—without suction or pressure—gently, naturally, effectively! Write for Bulletin CA-9.

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### CHINESE CERAMIC SOCIETY HAS AMERICAN CHAPTER

Long before the present industrial age, fine ceramic articles were produced in China. Several years ago the Chinese Ceramic Society was formed to modernize the industry. During the war, production of ceramics suffered severely and its revival is part of the national industrialization plan. Among the many students and engineers sent to this country recently are about 20 who are working in the ceramic industry. At the recent annual convention of the American Ceramic Society, several Chinese ceramists organized the American Chapter of the Chinese Ceramic Society. Officers elected were Kuan-Han Sun, Fellow of the American Ceramic Society, president; Chen-Chung Tan, a specialist on refractories, secretary; and Gordon P. K. Chu, an expert on glass technology, treasurer. The New York address of the chapter is the office of the treasurer, 111 Broadway.

The newly-formed branch is collecting used books on ceramics and old issues of journals and magazines for the war torn areas of China and would appreciate donations from American ceramists. They may be sent to the Chinese Ceramic Society, Science and Technology Library, University of Pittsburgh, Pittsburgh, Pa.

### CARBON DIOXIDE PUMPED TO CONSUMING PLANT

Newest and largest plant of the Liquid Carbonic Corp. is now in full-scale production of liquid carbon dioxide and dry ice at Belleville, N. J. The new plant is a modern structure embodying many of the latest trends in industrial plant design. It was built by the Walter Kidde Constructors, Inc. of New York. Indicative of the important role that location has assumed, the Belleville plant has been placed in immediate proximity to its largest consuming customer, Walter Kidde & Co., manufacturer of carbon dioxide fire extinguishing equipment. Whereas the carbon dioxide previously was delivered to this customer by truck or rail in the form of dry ice, it is now piped as a liquid under pressure directly to the consumer plant, eliminating many handling and shipping problems.

### HONORARY MEMBERSHIPS IN THE CHEMISTS' CLUB

Four honorary memberships in the Chemists' Club of New York, the first such honors to be awarded since 1939, have been granted by the Club's membership. Honorary membership is given to outstanding individuals in the chemical field and only 33 have been given since the practice was instituted in 1909. The four recently honored are William Cullen, director of Imperial Chemical Industries, Ltd., and English chemical consultant; Sir Robert Robinson,

a.c.f.

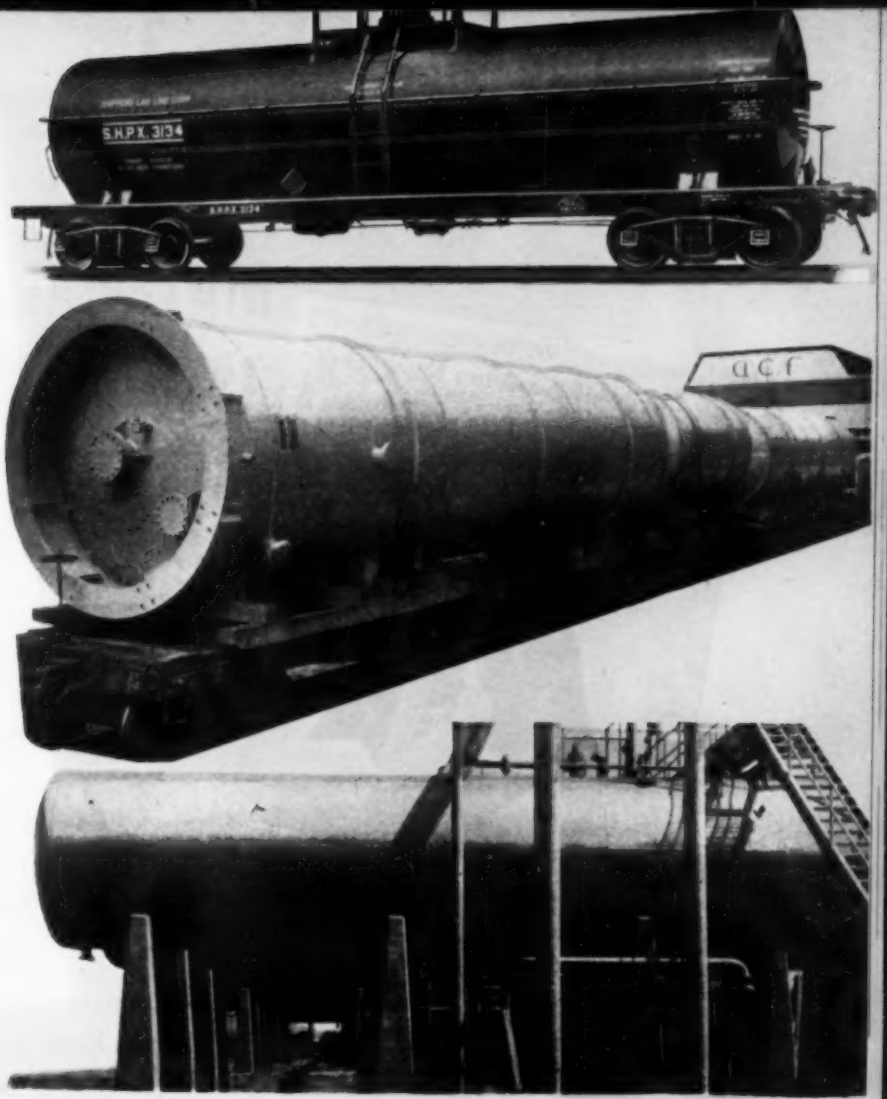
ADVANCED WELDING TECHNIQUE MEANS

# BETTER

TANK CARS

PROCESSING EQUIPMENT

STORAGE TANKS




**The service life you can expect from tank cars, processing equipment, and bulk storage tanks is in direct proportion to the lasting qualities of the welding techniques employed in their manufacture.**

**More than 30 years experience lies behind a.c.f. advanced welding methods—resulting in the development of precision machines and facilities today recognized as foremost in the industry.**

**a.c.f. "Unionmelt" submerged arc welding, for instance, is automatically controlled to produce smooth, consistent welds. Similarly, inner and outer welds are effectively joined and overlapped to provide greater strength and durability.**

**Stringent inspection in accordance with I.C.C., and A.S.M.E. U-68 and U-69 specifications assure the superiority of a.c.f. construction that results in greater safety, longer service life.**

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Waynflete Professor of Chemistry, Oxford University, and a world leader in organic chemistry; Maximilian Toch, president and chief chemist, Toch Brothers, Inc., chairman of the board, Standard Varnish Works, and a world authority in the field of paints and surface finishes; and Willis R. Whitney, formerly vice president and director of research, General Electric Co.

### SIGMA XI HONORS RESEARCH CLUB OF CORNING GLASS

A GROWING trend on the part of academic and industrial scientists to work together more closely in the furtherance of research was noted last month at Corning, N. Y., where the Research Club of Corning Glass Works was installed as a member of the Society of The Sigma Xi, national honor society. Dr. J. G. Baker of the Harvard Observatory delivered the charge to the new affiliates and Prof. Carleton C. Murdock, representing the executive committee of the society, presented the charter of membership to Dr. Gail Smith, president of the Research Club.

### NEW OVERSEAS TECHNICAL DIGEST MAKES ITS BOW

FIRST edition of a monthly industrial magazine, *The McGraw-Hill Digest*, published by McGraw-Hill Publishing Co., and directed toward the foreign field, came off the press on May 16. It has an initial circulation of 20,000 copies covering all countries except the United States and Canada. *The Digest* is an outgrowth of the *Overseas Digest* which was published during the war and distributed free of charge to the Armed Forces who sought current technical knowledge. By V-J Day it had reached a circulation of 197,000 copies.

### CHARLES S. MUNSON HEADS MANUFACTURING CHEMISTS

AT ITS annual meeting held at Skytop, Pa., June 5-6, the Manufacturing Chemists Association elected Charles S. Munson president for the ensuing year. Mr. Munson who is chairman of the executive committee of U. S. Industrial Chemicals, Inc., and president of Air Reduction Co., succeeds Harry L. Derby, president, American Cyanamid & Chemical Corp.

Other officers elected are Leonard T. Beale, president, Pennsylvania Salt Mfg. Co., and Harold O. C. Ingraham, president, General Chemical Co., vice presidents; J. W. McLaughlin, vice president, Carbide & Carbon Chemicals Co., treasurer; Warren N. Watson, Washington, secretary. George W. Merck, president, Merck & Co., was elected chairman of the executive committee.

### CORRECTION

IN THE introduction to the article "Bleaching Tallow with Sodium Chlorite" (*Chem. & Met.*, May 1946) the statement is made that "dry chlorine is generated outside the bleaching kettle, then bubbled through the hot tallow." Actually, it is dry *chlorine dioxide* that is generated outside the kettle.

*Consolidated's leadership continues!*

# THE NEW MODEL 21-102 CONSOLIDATED MASS SPECTROMETER *with* NEW *ionization chamber*

## IMPROVEMENTS

1. New type ionization chamber.
2. New filament supply and control.
3. New temperature control of the ionization chamber.
4. New ionization emission control.
5. New power supply.

## IMPROVED PATTERN STABILITY

### *More constant results*

– Temperature sensitive spectra greatly stabilized by exacting heat control.

– Up to 80% reduction in long term pattern fluctuation.

### *Fewer man hours per analysis*

– 25% to 35% savings in operating time by continuous automatic monitoring of ionizing current.

– Less recalibration required. Elimination of storage battery and charger saves time.

## A proven instrument

which provides the highest efficiency and accuracy for quantitative and qualitative analysis, research and control work. Write Dept. 6M for descriptive literature on this proven analytical tool.

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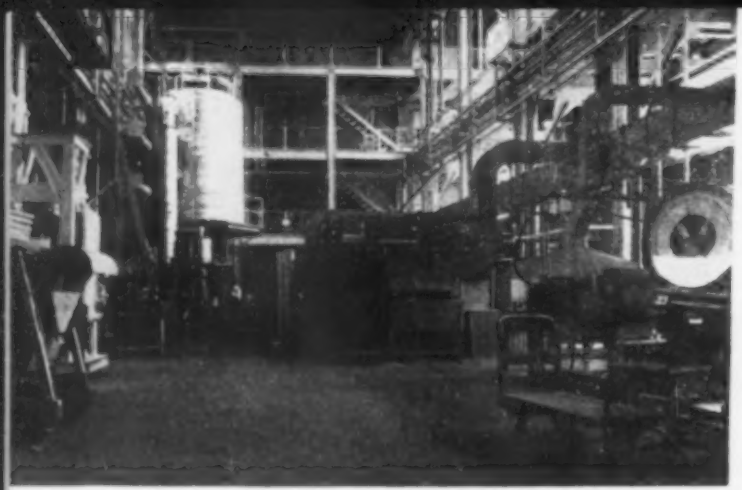


Pilot plant room in the Western Regional Research Laboratory of the U. S. Department of Agriculture at Albany, Calif., where studies on the industrial utilization of farm products are conducted on a pilot-plant or semi-commercial scale. For a news item on antibiotics research at the laboratory, see p. 178

# PACIFIC PROCESS INDUSTRIES

## TRENDS • EVENTS • DEVELOPMENTS

JOHN R. CALLAHAM, Pacific Coast Editor, San Francisco, Calif.

### GENERAL PETROLEUM EXPANDS TORRANCE REFINERY

In order to obtain more gasoline stock from the heavy, tarry crude residues left over from current refining methods, General Petrolem Corp. of California is now installing a delayed recycle coking unit at its Torrance, Calif., refinery. Cost of the unit, with supplemental facilities, is expected to be close to $5,000,000. In addition, an Edeleanu sulphur dioxide treating unit expected to cost $1,800,000 will be erected at the refinery later in the year. These expansions follow the wartime addition of four TCC units at Torrance.

The coking plant, being built by M. W. Kellogg Co., is expected to be completed during June. The installation includes two furnaces, four coking drums and conventional fractionating facilities. The two furnaces are identical, each serving alternately either of two of the four coke drums. Vapors from all drums will go to the common fractionating system. Under the planned operations of 17,000 bbl. of charging stock per stream day, the unit is expected to yield about 350 tons of coke daily. Some 65-70 percent of the charge will come off in the form of gas oil, 18-20 percent as gasoline stock, with the balance as gas. When finished, the Torrance installation will be one of the largest of its kind in the country.

Decoking of the drums will be by a hydraulic process rather than by the old manual or chain systems. The head of the drum is opened and a device similar to rotary well drilling equipment bores a hole through the bed of coke. A series of water nozzles revolving inside the hole breaks up the coke under a nozzle pressure of 1,200 lb. per sq. in. The coke is flushed from the bottom of the drum by the circulating water.

Engineering work for the Edeleanu unit has been completed and contract for construction awarded to E. B. Badger & Sons Co. This work is expected to be completed late this year or in early 1947. The unit is scheduled to be used in the manufacture of higher grades of diesel fuel, kerosene and solvents.

### GUAYULE TO BE HARVESTED BY PRIVATE FIRM

Private interests headed by Hugh Anderson, Pasadena, Calif., have acquired the Phillips 1,100-acre ranch in San Gorgonio Pass between Beaumont and Banning with intentions to harvest and process guayule rubber, according to a report. The guayule on the ranch was planted as part of the federal government's $40,000,000 wartime guayule rubber program, recently scrapped completely (*Chem. & Met.*, March 1946, p. 182). The stand on the Phillips ranch is said to be the largest remaining on sites formerly leased by the government.

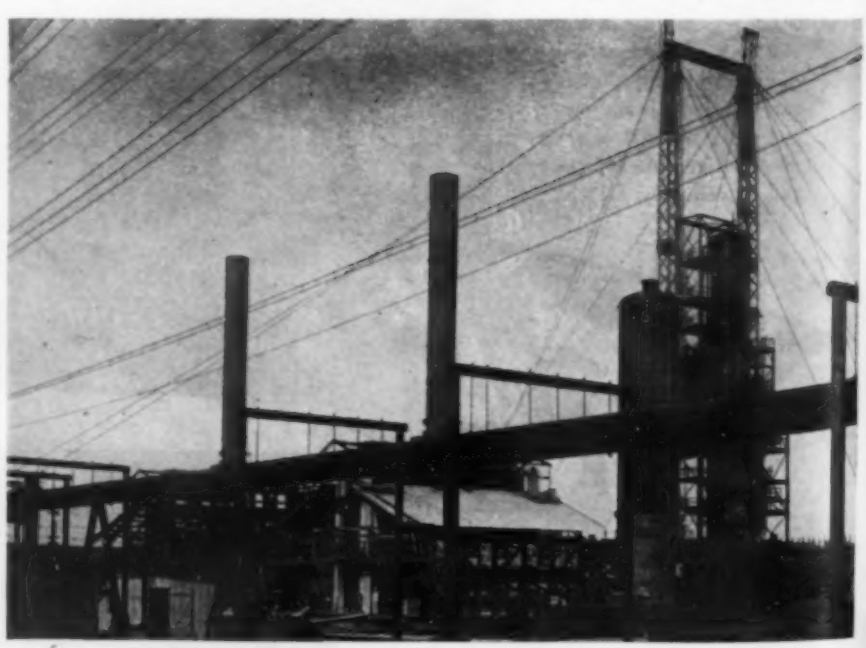
The guayule crops on the Phillips ranch are believed to be worth, according to reports, some $100,000 after processing in a new mill to be built by the present owners. Harvesting is expected to start soon.

### WEST'S FLUORINE INDUSTRY AT LOW EBB

Before the war, the West had no fluorine-producing industry. With the wartime building of five hydrofluoric acid alkylation units in petroleum refineries, a heavy demand for anhydrous acid arose in the region. General Chemical Co. then began production of AHF, together with intermittent manufacture of sodium fluoride and bifluoride and of ammonium bifluoride, at its El Segundo, Calif., plant. This firm is the only producer of fluorine chemicals west of the Rockies. However, with the closing down of three of the hydrofluoric acid alkylation units, the largest outlet for hydrofluoric acid has been severely restricted. Only the alkylation units of Standard Oil of California at Richmond and of General Petroleum Corp. at Torrance show promising prospects for continuing operations. With a combined alkylate capacity of some 4,700 bbl. daily and a probable consumption not greater than 1.0 lb. of AHF per bbl. of alkylate, these units could hardly consume more than 75 tons of AHF monthly. There are no other AHF-consuming industries in the West, since there is no production of freons, uranium fluoride, aluminum fluoride, or metal fluoride catalysts in the region.

In early 1945, there were 14 fluorspar mills equipped to produce acid-grade spar in the West, all located in Colorado, New Mexico and Utah. However, practically all of this raw material was shipped to the East. Western consumption of aqueous hydrofluoric acid and of most fluorine chemicals is relatively small, primarily because of the lack of consuming industries. However, with establishment of a large aluminum industry in the Northwest, consumption of anhydrous $AlF_3$ and of synthetic cryolite should now become stabilized for that region. Considerable cryolite is already used by western agriculture, and this insecticide shows promise of increasing usage. Freon refriger-

**Construction work is now progressing on the new $5,000,000 delayed recycle coking unit being built at the Torrance refinery of General Petroleum Corp. of California**



**GIANT RUBBER-LINED EVAPORATOR**
Evaporator or Crystallizer for use in large Rayon Plant to recover valuable crystallized chemicals from processing solution, 10'6" dia. 28' long. Lined with Manhattan Acid-Resisting Rubber. Weight approximately 30,000 lbs. Used under 29" vacuum.

# *You Get a "Plus" of Quality in* MANHATTAN Rubber Linings

**THE WORLD'S LARGEST RUBBER-LINED NICKEL PLATING TANK,** lined by Manhattan. Required 7 railroad flat cars to ship. Now in full operation with a large automatic elevator-type nickel plating conveyor.
(Photo courtesy Hanson-Van Winkle-Munning Company)

**RUBBER-LINED EQUIPMENT FOR METAL PICKLING PLANT—** Spent liquor sewers, fume exhaust ducts and stacks, drain piping and fittings all lined with Manhattan Acid-Proof Rubber Lining. For use in continuous strip pickling process in large steel mill. This part-shipment weighed 15 tons.

Companies engaged in the chemical processing and storing, metal finishing, plating and related industries have contributed in making Manhattan the foremost Rubber Lining manufacturer. Manhattan Rubber Linings are widely used on tanks, filters, impellers, mixers, agitators and troughs, blowers, exhaust fans and ducts, dipping cages, vacuum crystallizers, pipe and fittings, and on other equipment in endless variety of shapes.

## Your 40-Year "Plus" at Manhattan

1 - Experienced engineers and technique backed by 40 years of applying rubber to process handling equipment (53 years manufacturing other rubber products).

2 - Development of a special rubber-to-metal bond that defies mechanical separation.

3 - Compounding that will not crack or oxidize regardless of temperature changes and expansion or contraction of the metal.

4 - Utmost resistance to blows and abrasion.

5 - Enduring, dependable protection against corrosion and contamination.

6 - Elimination of stray currents.

7 - Extra long service and safety with resulting economies in handling most active acids, acid fumes, alkalies, salts, dye solutions and other caustic chemicals.

***Protect Your Equipment—Lower Your Operating Costs***
***Consult Manhattan on corrosion and contamination jobs.***

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## MANHATTAN RUBBER DIVISION

EXECUTIVE OFFICES AND FACTORIES — PASSAIC, NEW JERSEY

ants may grow in use as a result of the increase in quick-freeze units for processing western agricultural products. Growth in facilities for casting aluminum and magnesium will probably result in some increased demand for ammonium bifluoride, fluosilicate and fluoborate as sand agents. Demand for metal fluoborates will largely be dependent upon growth of the electroplating industry on the Pacific Coast. There is little or no demand for the metal fluoride catalysts largely used in synthesis of organic chemicals.

### NEW WHEAT GLUCOSE PLANT FINANCING ARRANGED

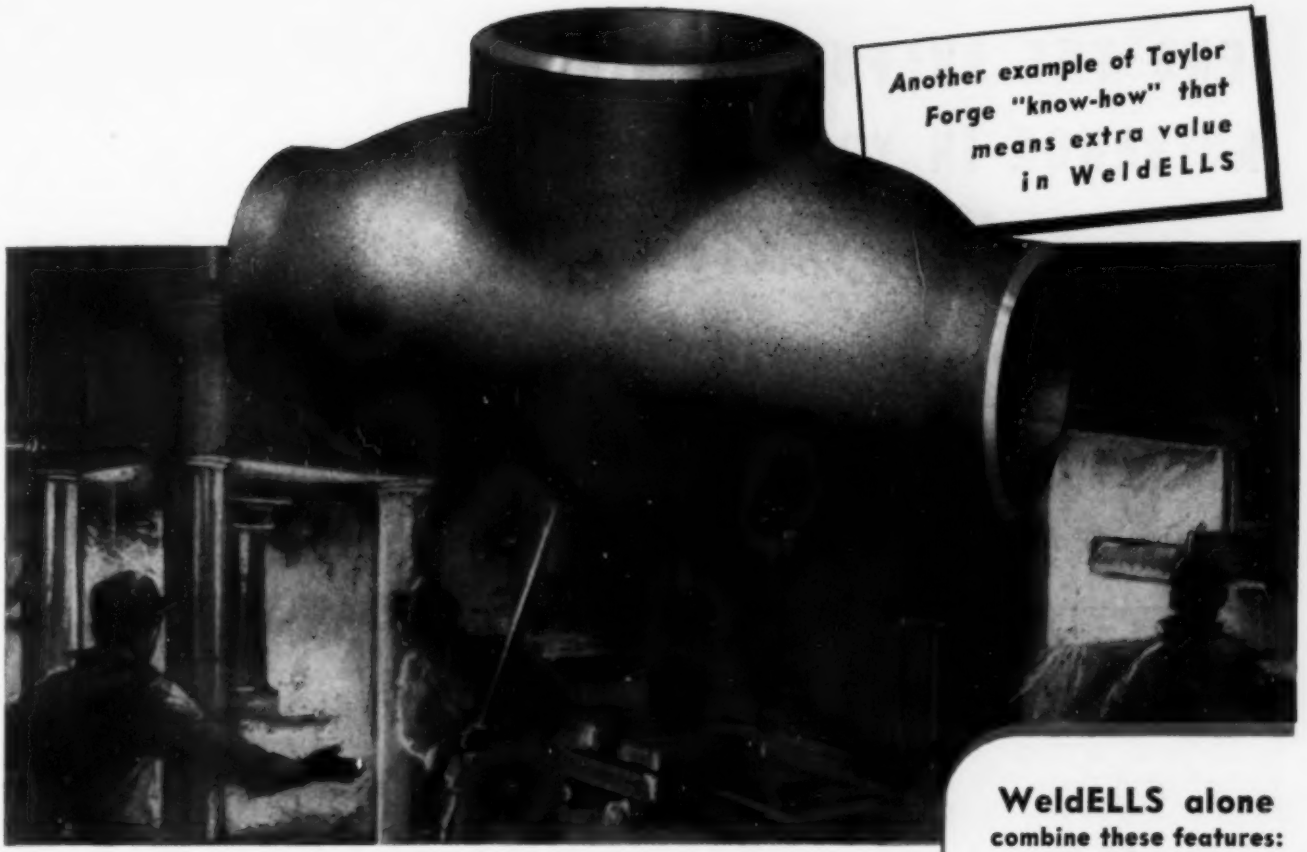
FINANCING has now been provided for the new $900,000 wheat starch and glucose plant to be built at The Dalles, Ore., by the Northwest Chemurgy Cooperative, Wenatchee, Wash., according to Henry P. Carstensen, president. Some of the $300,000 worth of equipment needed for the plant has already been ordered. The new unit will consist of a six-story building for producing wheat starch and two three-story wings for producing dextrose and glucose, together with storage space for at least 10,000 bu. of grain. Process to be used, the same as that used since 1943 at the Co-op's plant at Wenatchee, was introduced in this country by J. Lifszyc, Polish chemist now employed by Northwest Chemurgy. Essentially, the process consists of converting starch separated from cull wheat into glucose or dextrose by mineral acid hydrolysis. Animal feed will be a byproduct.

Northwest Chemurgy Cooperative already has three plants in operation in Washington. The Wenatchee unit is reported to convert 60 tons of cull wheat daily into starch and glucose, while the plant at Lynden produces the same products from cull potatoes. Another unit at Ellensburg produces potato starch. The two potato plants are said to be processing all the cull potatoes available in the surrounding territories. Experimental work is proceeding on developing other marketable products from potatoes.

Original purpose of the Northwest Chemurgy Cooperative was to develop new uses for wheat, production of which in the states of Washington, Oregon and Idaho has increased from 64 million bushels in 1909 to over 122 million bushels in 1945. The Cooperative purchases cull wheat from over 1,500 farmers who own the common stock. The Wenatchee plant, said to be the only one of its kind in the United States, produces starch, glucose, household sirup and a dairy feed byproduct; other chemurgic products from wheat such as gluten and wheat germ are reported to be under investigation. The new unit at The Dalles will be similar in design and operation.

### NEW TYPE ATOM-SMASHER BEING BUILT

A POWERFUL new type atom-smasher known as the synchrotron, designed for the acceleration of electrons as projectiles, is now under construction at the University of California, Berkeley. Scheduled for completion early next year, the machine will accelerate electrons to energies of 300 million electron volts, three times that of existing models of the betatron. Theoretically, it may be possible in the future to accelerate



**Another example of Taylor Forge "know-how" that means extra value in WeldELLS**

# *Rare specimen in Welding Tees—*

● *When you think of a reducing tee you always picture it as reducing in the branch. But this one, for the peculiar purpose it serves, had to be made the other way around. It's a seamless, carbon-moly forging, five inches in the run with a seven-inch branch—an "increasing" tee, so to speak; one more example of those kinks that are found so abundantly in the Taylor Forge bag of tricks.*

The "know-how" acquired during many years of performing these special—often extremely difficult—manufacturing operations, has a mighty important bearing on our standard line of WeldELLS, Welding Tees and other Taylor Forge Welding Fittings.

It means that in developing WeldELLS we did not have to ask what kind of fitting is easiest to manufacture. Instead we asked what comprises the ideal fitting, and then, with every special facility and process at our command, made that conception a reality.

That is why WeldELLS have tangents . . . why they have extra reinforcement where service stresses are greatest . . . why they have such extremely accurate dimensions . . . why they have the features listed opposite . . . why, in short,

## WeldELLS have everything

**WeldELLS alone combine these features:**

- **Seamless** — greater strength and uniformity.
- **Tangents**—keep weld away from zone of highest stress—simplify lining up.
- **Precision quarter-marked ends**—simplify layout and help insure accuracy.
- **Selective reinforcement** — provides uniform strength.
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- **Machine tool beveled ends**—provides best welding surface and accurate bevel and land.
- **The most complete line of Welding Fittings and Forged Steel Flanges in the World** — insures complete service and undivided responsibility.

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electrons to energies of one billion electron volts with larger synchrotrons. Principle of the new machine is said to be as important a development in atom smashing as was the cyclotron.

Fundamental principle of the synchrotron is based on the "theory of phase stability" which makes it possible to shoot projectiles around a circular orbit an indefinite number of times by having them always arrive at a given point in time to receive an electrical acceleration. Thus the tendency of cyclotron projectiles to lag and thus fail to be accelerated will be overcome. Dr. E. M. McMillan, co-discoverer of neptunium and a leading nuclear physicist, devised the principle of the synchrotron and is supervising the construction. The Manhattan District is assisting the project, according to Dr. E. O. Lawrence, director of the University's Radiation Laboratory.

## PAINT FIRM ENLARGING PLANT FACILITIES

NEW FACILITIES for the manufacture of paints and varnishes are under construction by W. P. Fuller & Co., oldest and largest manufacturer of paint products in the West, at the firm's S. San Francisco plant. Estimated to cost in the neighborhood of $150,000 with equipment, the expansion consists of two new buildings adjoining present facilities. Construction work, begun last fall, is again proceeding after many interruptions. George Gibson is in charge of the firm's engineering and construction division.

In addition to paint, varnish and lacquer products, the S. San Francisco plant is a large producer of white lead and lead oxides. The firm, established in 1849 and with other factories at Los Angeles and Portland, produces a complete line of architectural and industrial finishes including waterproof and corrosion-resistant coatings used by the chemical process industries.

## PROCESSED WASTE BARK COMMERCIALIZED

AFTER several years of research, processes have now been developed by Weyerhaeuser Timber Co., Longview, Wash., to convert log bark, one of the biggest waste products in lumbering, into commercial products, according to a recent announcement by Clark C. Heritage, technical director of the firm. This is considered to be the very first time that bark of timber trees has been put to profitable use in the Northwest and one of the first times in the history of the nation's lumbering industry. Construction work is now under way for the new bark-process plant near the firm's projected Longview plywood unit, which will be the present source of bark supply; it is expected that the plant will be in operation by September. Until the bark processing plant reaches satisfactory operations, it will be under the supervision of R. D. Pauley, manager of the development department, instituted in 1942, who also has charge of the pilot plant now producing for the market. At full production operations, the commercial plant is expected to employ about 30 workers and turn out a carload of finished product daily.

In the Weyerhaeuser processes, on which patents are pending, bark is broken down into three basic components—small flakes of a cork-like material, a fine powder of brown


*Methallyl chloride and methallyl alcohol are new allyls now available in trial-lot quantities from Shell Chemical Corporation. Chemical properties are similar to allyl chloride and allyl alcohol — made available in commercial quantities last year.*

**METHALLYL CHLORIDE** undergoes the usual replacement reactions of the chlorine atom, and reactions involving the double bond. Ammonolysis produces primary, secondary and tertiary amines; chlorohydrination produces dichloro-tertiary-butyl alcohol. Methallyl chloride hydrates easily in the presence of aqueous solutions of mineral acids to produce chloro-tertiary-butyl alcohol.

In addition, methallyl chloride is an effective fumigant for grains, tobacco and dried fruits.

**METHALLYL ALCOHOL** readily forms esters. Those of lower organic acids are formed by distillation of the alcohol with the desired acid. Dibasic esters can be conveniently prepared by reacting acid anhydrides with methallyl alcohol in the presence of p-toluene sulfonic acid.

These esters undergo polymerization in the presence of peroxide catalysts . . . the dibasic esters yielding hard, chemically resistant, thermosetting resins. Methallyl alcohol thus offers new possibilities in the growing field of allyl resins.

**PHYSICAL PROPERTIES**

| | METHALLYL CHLORIDE | METHALLYL ALCOHOL |
|---|---|---|
| Boiling Point °C.@ 760 mm. | 72.2 | 114.5 |
| Specific Gravity 20/4°C. | 0.9257 | 0.8515 |
| Refractive Index 20/D | 1.4276 | 1.4255 |
| Solubility in Water @ 20°C. | Less than 0.1 grams per 100 grams | Approx. 17 grams per 100 grams |
| Flash Point °F. (Tag Open Cup) | 14 | 94 |

**SHELL CHEMICAL CORPORATION**

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soft tissue, and a hard tissue consisting of small, sticky fibers. From these, the plant separation process can yield five products. One is primarily cork, while the others are derived equally from each of the two other basic fractions. However, only three of the products to be commercialized have been announced. One is used in compounding resin glues for exterior-type plywood manufacture; this product will be used in the new Weyerhaeuser plywood plant at Longview. Demand for the glue extenders, also said to reduce the cost of glue formulation, has been in excess of the production capacity of the present pilot plant. Another of the products is a thermosetting molding compound, while the third will be used as an ingredient in the compounding of certain insecticides. Although other uses for the components of bark are under development by Weyerhaeuser, the company does not intend to produce any of the finished products for the time being but plans instead to sell the raw materials to other manufacturing and formulating firms.

Source of bark for the immediate future will largely be sawing operations of the new plywood mill. However, most important aspect of the entire series of developments is that bark, at present useful largely as a cheap fuel, now becomes a profitable by-product that will probably develop markets of a magnitude to justify barking the logs prior to sawmill operations. Company engineers are evidently anticipating such a development, for engineering work is now under way toward evolving the most suitable type of barker that could be used on logs before actual sawing in the mills. This, meaning that every bit of a log could be utilized either for lumber, pulp or bark products, would be a major step forward in more efficient conservation and utilization of the nation's wood resources.

### PINE-ROOT AVIATION GAS USED BY JAPANESE

At the end of the war, Japan was producing 400,000 bbl. of 94-octane aviation gasoline annually from pine roots, reports George L. Neely of Standard Oil of California, San Francisco, who headed the petroleum division of the U. S. Naval Technical Mission in Japan. In fact, Neely predicts, the native intelligence and marked creative ability and ingenuity of the Japanese in scientific work, coupled with a high appreciation of the value of research, may well make Japan the scientific equal of prewar Germany within a few decades, although the country is not yet "of age" technically.

As an example of Japanese strides in petroleum research, Neely cited that the world's largest petroleum research plant was operated by the Japanese Navy near Tokyo. The project cost $35,000,000 and included 78 laboratory buildings; 3,200 workers were employed. By the end of the war, the Japanese had developed processes for producing petroleum substitutes from pine tree roots and needles, rubber, barks of certain trees, orange peelings, sweet potatoes and soy beans.

Astounding as it may seem, the extraction of oil from pine roots, although highly expensive, became Japan's principal substitute source of aviation gasoline. Pine roots were split into kindling size by Japanese farmers and placed in simple, closed

kettles, of which there were thousands scattered throughout the countryside. A fire was lit under the kettle and the oils vaporized from the roots by dry distillation and condensed in water-cooled pipes. The small container of crude pine roots was then taken by the farmer to the nearest village, where it was stored and eventually shipped to the refinery. The char left in the kettle was used as fuel for the next distillation. At the refinery, a catalytic process was used to convert the unsaturated compounds into aromatics which, after addition of 4 cc. of TEL, gave an aviation fuel of 94-octane rating. Some 2,500,000 bbl. of pine root oil was needed to give an annual output of 400,000 bbl. of 94-octane fuel. At this rate of production, the pine trees of Japan would have been exhausted by the end of 1946.

### LONGVIEW MILL ADDITIONS PLANNED BY WEYERHAEUSER

New construction now planned by Weyerhaeuser Timber Co. at its Longview, Wash., plant, will cost some $1,295,000 according to a recent report. Civilian Production Administration has approved construction of a plywood plant costing $995,000 and miscellaneous work on the mill, docks and machine shop to cost some $300,000. For developments on the new bark processing plant under construction, see *Chem. & Met.*, p. 172. This new construction is in addition to the $5,000,000 pulp mill previously announced (*Chem. & Met.*, Oct. 1945, p. 178). The new sulphate mill planned for Longview will turn out 70,000 tons of pulp annually. In addition, work is reported now under way on the conversion of the 90,000-ton bleached sulphite plant to a new magnesia process that is said to require 15 percent less wood than the present sulphite method of pulping. The magnesia process will allow economic recovery of a substantial portion of the MgO and sulphur values of the treating chemicals.

### LOS ANGELES PLASTICS FIELD NEEDS RAW MATERIALS

Although Los Angeles is one of the leading plastics molding, forming and machining areas of the country, practically all the raw materials used there must be shipped from plants located east of the Mississippi River. Even very little plastic powders, sheets, rods and tubes, or fibers are made in Los Angeles, according to a survey just completed by the industrial department of the Los Angeles Chamber of Commerce. Of the 369 plastics fabricating and molding plants in the 11 western states, 299 are located in this county, according to the survey. This represents a rapid growth over 1925 when there were about ten plastics firms in the area, as well as over 1942 when only about 50 plants were in existence. Los Angeles County ranks among the nation's highest producing centers in output of airplanes, assembly of automobiles, manufacture of furniture and house furnishings and in production of sportswear, all of which are increasing consumption of plastics and resins.

Of the plastics and resins raw materials, casein is produced in the Los Angeles area by two firms, styrene by one, glycerin by three, natural phenol by one, acetone by

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**It's compact, but it handles *full flow***

**It's positive, but it never interrupts production**

***Every drop of the fluid you want cleaned gets cleaned by the Cuno "filter-fine" strainer.***

No larger than the usual partial-flow type, it handles full flow without the necessity of an expensive, space-consuming duplex installation. Every drop of the fluid is inspected by the permanent, all-metal filter element — built-in or externally mounted.

Providing absolute certainty of removing all particles larger than specified (down to .0025"), it is also continuously-cleanable *while in operation.* No production delay due to a clogged filter — or for cleaning the filter.

The Cuno catalog in SWEET'S tells which Cuno model is best for your requirements — or send for complete catalog (use coupon). Cuno's engineering staff will also help you on special conditions.

KEEP FLOW ON "GO" WITH

**CUNO**

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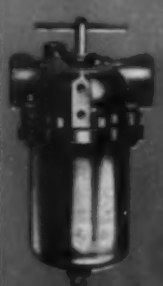
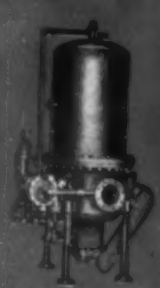


AUTO-KLEAN *disc-type.* For all fluids except those containing highly abrasive solids. Viscosities from 30 to 50,000 Saybolt seconds. Minimum pressure drop. Continuously cleanable by turning a handle (manually or automatically). Occupies no more space than usual partial-flow type. Sizes from 1¾" diam. x ¾" cartridges to massive motor-driven models. Available with or without sump for built-in or external installations.



FLO-KLEAN *wire-wound.* For fluids containing highly abrasive solids such as metal chips, abrasive wheel particles, sand, etc. May be designed to remove particles .0025" or larger. Continuously cleaned by backwash system. Low pressure drop — fluid moves in straight line, encountering only momentary restriction. All parts made of metal — constructions to meet varying corrosive and erosive conditions.

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Others .....

*Name*.....

*Company*.....

*Address*.....

*Title*.....

one and alcohol by three. Resins are produced in the area by seven firms, according to the survey. Many of these operations are small and will probably remain so until local manufacture of basic plastics materials provides greater outlets.

## BURNT LIME YIELDS IN CALIFORNIA INCREASE

COMPLETE 1945 returns from producers, supplied to the statistical section of the California Division of Mines, show an increase in production of burnt lime of 9,578 net tons over the 1944 yield. These figures do not include lime burnt from dolomite and used in the reduction of magnesia from sea water, as dolomite is treated as a separate mineral substance. In 1944 there were 164,494 tons of limestone burnt to yield 82,247 net tons of lime valued at $883,009 while in 1945 the yield from 183,643 tons of limestone was 91,825 net tons valued at $997,236. The following table gives the quarry location of producers during 1945.

**California Producers of Burnt Lime—1945**

| Operator | Quarry |
|---|---|
| Westvaco Chlorine Products Corp. | Newark |
| Diamond Springs Lime Co. | Diamond Springs |
| California Portland Cement Co. | Colton |
| Chubbuck Lime Co. | Chubbuck |
| Henry Cowell Lime & Cement Co. | Santa Cruz |
| U. S. Lime Products Corp. | Sonora |

## IDAHO ALUMINA CLAY FIND ATTRACTS ATTENTION

DISCOVERY of a large deposit of high-grade alumina clay in western Idaho, said to average close to 20 percent $Al_2O_3$, is attracting considerable attention in Northwest light age close to 20 percent $ALO_3$, is attracting by the fact that the deposit is very near the Kaiser alumina reduction plant at Mead, near Spokane, Wash., which is dependent upon a Louisiana plant for its alumina cell feed. In addition, much speculation has recently centered around activities of the Aluminum Co. of America to develop the high-alumina clays of Oregon for its Pacific Northwest reduction plant.

Investigated jointly by the U. S. Geological Survey and the U. S. Bureau of Mines, the new "Excelsior" find is reported to contain an estimated 12,530,000 tons of ore, dry basis, that averages 28.7 percent alumina, 5.6 percent available iron oxide and a high percentage of titanium oxide, raw material for high-quality white paints. At present, there is no production of pigment-grade titanium dioxide in the West.

## ANTIBIOTICS WORK PROGRESSES AT REGIONAL LAB

DEVELOPMENTS on several new antibiotics which show promise for use in medicine were recently disclosed at the Western Regional Research Laboratory of the U. S. Department of Agriculture at Albany, Calif. Three of the antibiotics are now in the laboratory-clinical stage of development, one is ready for pilot plant demonstration, while another has reached limited commercial production. The culture medium which seems to offer most promise for use in large-scale production technique is processed asparagus butt juice, a large agricultural waste product in certain western states. Development of this waste as a culture medium was largely


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# ALUMINUM ORE COMPANY

*Aluminas and Fluorides*

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the result of work conducted at the Albany laboratory (*Chem. & Met.*, March 1946, p. 178). The accompanying table summarizes the status of the new antibiotics on which work has been done at the WARRL. (Photo of laboratory on p. 168.)

A simplified procedure for preparing pure crystalline lysozyme, a bacteria-destroying enzyme, from waste egg whites was developed at the Western Regional Research Laboratory. The process is now ready for pilot plant demonstration and if lysozyme proves to be valuable in therapeutics or as a food preservative, it is believed to be feasible for commercial extraction at large egg freezing and drying plants. However, unless lysozyme can be modified by chemical treatment to destroy its shock-producing ability, use as an antibiotic against pathogenic bacteria must probably be limited to the surface of the body.

Citrinin was produced at WRRL by culturing the mold *Penicillium citrinum* on an asparagus juice concentrate medium. It can be purified by sublimation under reduced pressure or by solvent extraction. This antibiotic is now being evaluated as a potential therapeutic agent. Subtilin, an antibiotic found and produced by Albany scientists in 1943, can now be prepared by a modified process developed at the laboratory that gives a product about three times as active as that obtained by the original method. Pharmacological studies on toxicity of subtilin are now under way. Results of preliminary work, conducted cooperatively by WRRL and the University of California, indicate that on guinea pigs subtilin shows a marked suppressive effect on tuberculosis infections.

Tyrothricin, now produced on a limited commercial scale for external use against certain microbial infections, can be produced in higher yields when an asparagus butt juice concentrate is used as the culture medium, according to WRRL research findings. Since tyrothricin destroys red blood corpuscles, its use in therapeutics is limited. However, it can be fractionated into two distinct antibiotics, one of which is gramicidin. This substance is also toxic, but it has been recently discovered at Albany that treatment with formaldehyde greatly reduces the hemolytic effect while largely retaining the antibiotic activity. Further studies of the chemical and biological properties of this promising modified gramicidin are in progress.

**Recent Developments in Antibiotic Substances[1]**

| Substance | Source | Preparation[2] | Stage of Development |
|---|---|---|---|
| Lysozyme | Waste egg whites | asparagus juice culture | ready for pilot plant |
| Citrinin | *Penicillium citrinum* | asparagus juice culture | laboratory-clinical |
| Subtilin (mod.) | *Bacillus citrinum* | membrane purification[3] | laboratory-clinical |
| Tyrothricin | *Bacillus brevis* | asparagus juice culture[4] | limited commercial |
| Gramicidin (mod.) | *Bacillus brevis* | tyrothricin fractionation[5] | laboratory-clinical |

[1] As developed at the Western Regional Research Laboratory and Pharmacological Laboratory, (Albany, Calif.) and other units of the U. S. Dept. of Agriculture. [2] As indicated at the present stage of development. [3] Of crude subtilin extract from spent culture medium. [4] A modified culture medium shown to give increased yields. [5] Fractionation of tyrothricin and subsequent treatment of the gramicidin fraction with formaldehyde.

# NEWS FROM ABROAD

## IMPERIAL CHEMICAL INDUSTRIES HAS LARGE EXPANSION PROGRAM FOR ITS DYESTUFFS DIVISION

**Special Correspondence**

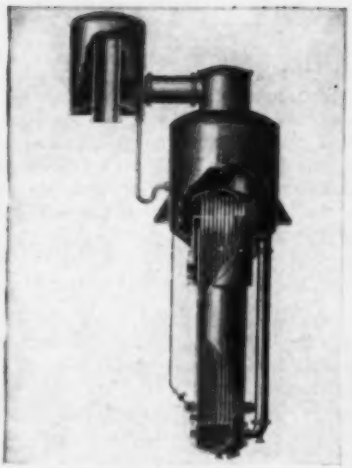
WHILE THE Wilton site is being prepared for the new £10,000,000 organic chemicals plant of Imperial Chemical Industries Ltd. in northeast Yorkshire, expenditure of similar magnitude is being planned by this leading combine of Britain's chemical industry in its dyestuffs division. The manufacturing facilities at Blackley and Trafford Park, Manchester, at Grangemouth, Stirlingshire, and at Hoddersfield, Yorkshire, will be extended at a total cost of £8,000,000, and another £1,000,000 will be spent on additions to the research and testing station at Blackley.

The three factories at Blackley—headquarters of the I.C.I. Dyestuffs Division—Trafford Park and Grangemouth so far contrated on making dyestuffs; the Huddersfield plant will be concerned largely with intermediates. The research station at Blackley developed several important new drugs and insecticides over the past few years, but its main object will still be to develop better dyes and textile chemicals. Directly or indirectly, almost the whole £9,000,000 will thus be spent in the dyestuffs field.

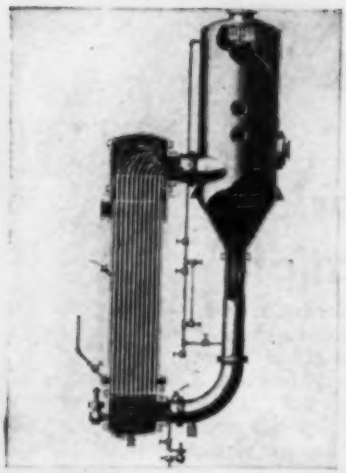
The need for economy in the use of dyestuffs was brought home to the British public by wartime fashions with their pastel shades and limited range of colors. Now that the armed forces need less, the export market calls for more dyestuffs, and the home consumer must still wait for the return of brighter and stronger colors. The extensions to be put into effect at I.C.I. dyestuffs factories probably serve in the first place for an expansion of export sales. With the—at least temporary—eclipse of German competition the foreign market for British dyestuffs seems almost unlimited, a fact which should make it easier for I.C.I. to obtain the necessary plant for its extension program.

The Wilton plant and the dyestuffs factories together will absorb less than half the total of over £40,000,000 capital expenditure projected under a provisional long-term program for the next eight years. Though this program, which has only just been announced, has not yet reached the stage of concrete plans, it has been stated that the first instalment will include important extensions of the alkali works and modernization of power plants in addition to the proposed work in the dyestuffs division.

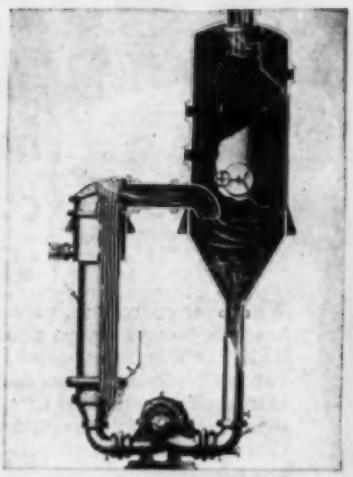
In assessing the significance of this capital expenditure two factors deserve special mention: The acquisition of certain war factories which I.C.I. operated for the government during the war and will now run on



Long Tube Film Type Evaporator

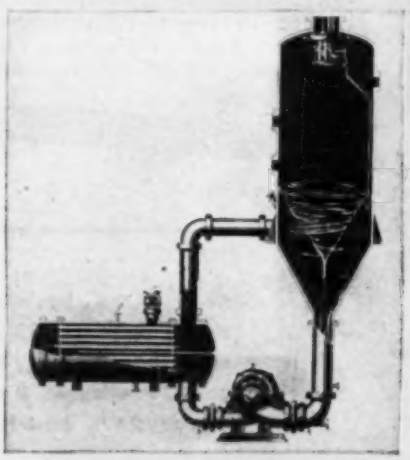


Long Tube Vertical Recirculation Evaporator



Vertical Tube Forced Circulation Evaporator

# *General American Conkey Evaporators*



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its own, especially in the light metals field, and the anticipation of a research and development expenditure this year of £3,350,000, a figure equal to about one-fifth of all manufacturing profits. The latter item shows that the expenditure on new plant goes hand in hand with an intensification of technical and chemical research, the former reveals the war-conditioned stimulus to certain fields of the company's activities which for this reason do not feature so prominently in the eight-year program but will continue to progress.

### OTHER EXPANSIONS

The projected expenditure of £40,000,000 over the next eight years compares with a consolidated balance sheet total of lands, buildings and plant of £48,600,000 at the end of 1945 when the company held cash and government securities shown at £17,850,000. These figures give some idea of the magnitude of the proposed plant additions in relation to existing factory capacities. I.C.I. does not stand alone with such ambitious expansion schemes. Reference was made in these notes to Courtauld's modernization and expansion program which was expected to absorb similarly large sums, and the reports of smaller chemical companies in Great Britain reveal the same pre-occupation with extension schemes, while balance sheets generally testify to a strong financial position.

True, this is partly due to neglect of normal plant repair and maintenance during the war and to smaller stocks of raw materials and finished manufactures. Government discouragement of higher dividends and the anticipation of substantial reconstruction and extension needs also has something to do with the retention of liquid funds by industrial companies. The continuation of official controls over capital issues is another factor making for conservative financial policies. But none of these factors would have become effective had not wartime capacity production permitted the industry to work with a satisfactory profit margin. The projected expansion will therefore be mainly financed out of the chemical producers' own resources.

That modernization of power plants is one of the main features of the first instalment of the I.C.I. construction program draws attention to the importance of satisfactory fuelling and power arrangements in new plants. Production in some chemical factories was held up last winter by shortage of coal, and the higher cost of fuel necessitates economy in its use. Unfortunately some of the older chemical works in England, built at a time when coal was both cheap and plentiful, use more fuel than can be justified at the present time of shortages. All chemical manufacturers will have to tackle the problems resulting from uneconomical power plants.

### EQUIPMENT PLANTS

When Courtaulds announced its big expansion program, the company included plans for a factory to build textile and other machinery needed in its own plants. It would not be surprising if chemical producers generally would pay more attention to chemical engineering sections of their own, for provision of plant is likely soon to become one of the major bottlenecks in all expansion schemes. The British iron and

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| Water Not More Than | 0.3 |
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| Color Not Darker Than | C-¼ |
| Specific Gravity at 15.5°/15.5°C. | 0.948-0.956 |

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| | |
|---|---|
| Freezing Point | Min. 20°C.* |
| Water Not More Than | 0.5 |

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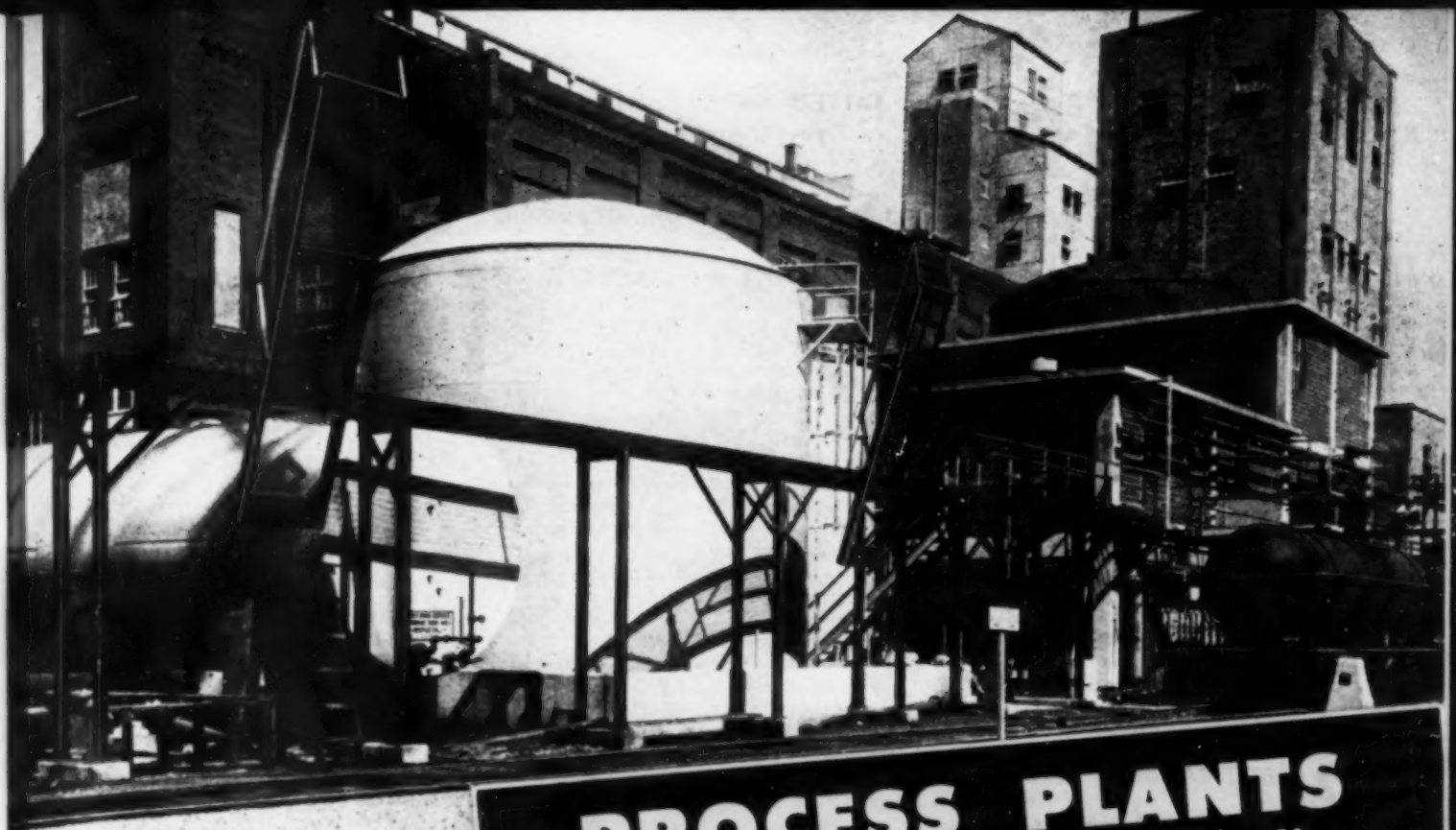
steel industry which intends to invest £168,000,000 in new iron and steel furnaces and mills stated that to meet this huge demand for new plant, big orders would have to be placed not only with British but also with U. S. engineering firms. The position in the chemical engineering industry is not greatly different. The new plant requirements of British chemical manufacturers cannot be met by British engineering firms without considerable delays.

### CONSTRUCTION COSTS

The plans of the iron and steel industry assume that the average cost of new construction has doubled since prewar days, and though the return of more normal conditions may lower the cost of new plant, there is no doubt that the present cost of chemical plant is also nearly twice as high as before the war. Interest rates, on the other hand, have been reduced by skilful management of the capital market, and it may be thought that the saving in interest on borrowed capital is almost sufficient to offset the extra cost of plant resulting from present high prices, especially if the increased efficiency of modern installations is taken into account. Other costs, including in particular the wage bill, have also risen, and the changes in costs as a whole certainly work in favor of mechanization. Fuel and labor economy are likely to be the dominating features of plant construction in the next few years.

The higher the amount of money invested in plant as compared with the costs of operation, the more important it is, of course, to insure that plants are run at or near full capacity and that duplication by competing producers is avoided. The tendency towards bigger plant and vertical concentration of production to reduce transport requirements puts a premium on full-capacity work. With demand at its present level conditions are certainly favorable enough as far as this aspect of plant operation is concerned, but in some of the newer sections of the chemical industry, especially in the plastics field, there seems to be a tendency for producers who entered the industry as suppliers of one particular type of synthetic resin to spread both horizontally and vertically, with results on the industry as a whole which cannot yet be safely assessed.

There is, however, one section of the chemical industry in which plant extensions must as yet be postponed although demand is perhaps more pressing than anywhere else. Pinchin Johnson & Co., the leading firm in the paint industry, reported that the productive capacity of its various works is geared up to meet what should be the company's share of the demand, but the dominating factor is the raw material supply. There is a shortage of drying oils and other paint materials which shows little indication of a likely improvement in the near future, and while this state of affairs continues, there is little point in extending manufacturing facilities. There is, however, a great potential need for increased paint producing capacities, and as the financial position of the leading paint manufacturers does not differ much from that of other chemical producers, it seems likely that sooner or later this branch of the chemical industry will also experience a big extension and modernization drive.



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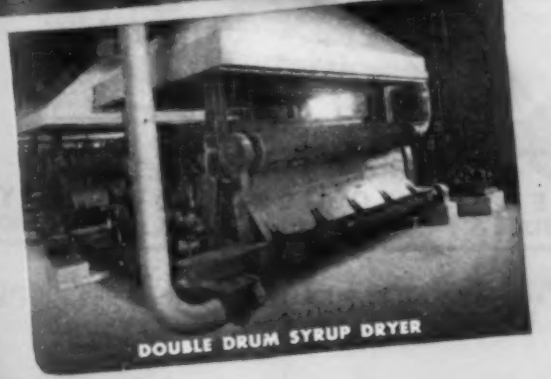

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## GOVERNMENT PRODUCTION OF DDT IN SOUTH AFRICA PUTS PRIVATE ENTERPRISE ON THE DEFENSIVE

Special Correspondence

THE ATTITUDE of industry towards the government's policy of manufacturing DDT has been defined by the director of the South African Federated Chamber of Industries, who said there were three main points in the attitude of the Chamber. The first was that industry was strongly opposed to any government policy of setting up factories to compete with private enterprise. Secondly, it was realized that special circumstances compelled the government to manufacture DDT at the present time, but it was maintained that these circumstance should not be allowed to establish the principle of state interference with private enterprise. Thirdly, industry was definitely opposed to any attempt by the government to compound and distribute DDT to the public in competition with industries well organized to handle this business.

When the manufacture of DDT concentrate was first suggested as a government enterprice the Federated Chamber of Industries indicated to the Minister of Economic Development that it opposed any encroachment on the sphere of private enterprise as a permanent measure. The Minister, however, pointed out during many discussions on this matter that DDT was urgently needed by farmers and that there were no factories able to manufacture the insecticides at short notice. The Federated Chamber finally accepted the Minister's assurance that no public utility company would be established to distribute DDT and that its manufacture would be undertaken by a departmental factory only as a temporary measure.

The Chamber is still opposed to any intention by the government to make DDT up as an insecticide, as there are now factories able to undertake this work. If the government were to mix and distribute the finished product existing enterprises would be seriously affected and unemployment would result. On this point the Chamber has the Minister's assurance that the mixing and sale of DDT as an insecticide is only an interim measure, and that eventually the bulk of this business will be handed over to private enterprise.

A plant for the manufacture of cyanide for use by the gold mining industry is to be set up during the current year by African Explosives and Chemical Industries at the Klipspruit Sewage Disposal Works, outside Johannesburg. Methane gas, one of the products of sewage disposal, will be used in the manufacture of cyanide, and the company's synthetic plant at Modderfontein will supply the necessary ammonia. The company states that the new development has been made possible by close cooperation with Imperial Chemical Industries, Ltd.

It is considered possible that South Africa may lead the world in the production of fish flour for human consumption. It is claimed

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that large-scale production of fish flour for human consumption would solve the food problems of the Union and most other countries. Although South Africa is leading the world in the quest for the perfect fish flour for human consumption there remain certain snags in the way of large-scale production. An expert will leave shortly for the United States, Canada and Britain to search for machinery that can be used to overcome these snags.

### SULPHUR RECOVERY

In the latest report of the Fuel Research Institute it is stated that owing to a threatened shortage of imported sulphur, experiments on the recovery of sulphur from pyrites in colliery washery wastes were undertaken. One investigation by the Wartime Research Committee showed that large amounts of pyrites could be recovered from Rand gold ore and that this source of supply would be much cheaper than pyrites from colliery waste. It was found that sulphur production from colliery waste would be expensive because the waste is located at different places, and thus crushing and handling costs would be high, and the final pyrites would still contain a fair amount of carbon. This finding, as well as the improved shipping position, led to the abandonment of the investigation.

A vacuum filter is being manufactured in South Africa, an inexpensive unit that is adequately meeting the requirements of milk laboratories where a number of pulps are being handled, and where quick and accurate filtering is required. The filter consists of two castings, the upper of which is the pulp container and the lower the base. The top casting is heavy enough to form an air seal between the filter medium and the base, and two dowel pins keep the castings in position, thus eliminating the need of clamps and thumb screws. The pulp to be dewatered is poured into the container, the vacuum is applied, and the solids are left in a cake on the filter paper. The filter paper and the cloth are supported by a wire screen placed over the drain grooves in the base. A tapped opening is provided for the filter connection, and the filter cake can easily be washed if this is desired.

Production of gum turpentine in the government pine forests near Cape Town reached a new level in 1945, when altogether 6,000 gallons of gum was tapped from the trees. These pines proved of inestimable value during the war when supplies of turpentine from overseas were limited. The tapping of the pines during the past four years has become a feature of the work of the Forestry Department near Cape Town, and supplies of the gum are sent monthly to Pretoria for processing.

A plan for a "central service station" for the South African chemical industry is to be put into effect. The adviser to the government on industrial chemical research said the station would advise, but not interfere with, private industry. It would be staffed with experts, and would provide library and laboratory facilities to aid industries in keeping abreast of current scientific information and in carrying out research projects. It would aid industry in the disposal and utilization of waste products, and bring the finest brains possible to bear on the problems of individual industries. The station will be


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NORELCO products include: Quartz crystals, cathode ray tubes, industrial and medical X-ray equipment, fine wire, diamond dies, tungsten and molybdenum products.

*The Norelco X-ray Diffraction apparatus, with four camera positions, permits diffraction pattern exposures in any or all of the four positions at one time. It is compact and convenient to operate. Norelco X-ray Diffraction apparatus serves in research and production control work.*

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part of the larger National Scientific Research Council.

The Secretary of Public Health said the government was now experimenting to ascertain the best way of introducing food yeast into the daily diet of large sections of the population who needed it most. It would first be necessary to establish a basic diet and then to build it up into a properly balanced diet. It was hoped that South Africa would be able to provide the basic diet. He said: "It is not a question of producing food yeast by the ton or allowing it to get on the market as another magic cure for all ills. The government is making arrangements to buy it and to feed it to the people in the proper way. Now that authority has been given for the government to purchase 50 tons of food yeast from a Natal firm, these things will be investigated by the nutrition section."

According to a government statement, in 1944 South Africa exported 6,732,609-lb. of soap and in 1945, 5,446,828-lb. The quantity of soap supplied as ships' stores in 1944 was 356,490-lb., and from January to November of last year the quantity was 172,110-lb.

### NEW MATCH COMPANY

A new company with a capital of £300,000 was recently formed under the name of the Capital Match Corp., Ltd. The company proposes to manufacture safety matches at Bloemfontein, where a 20-acre site may be purchased. The address of the head office is P.O. Box 5561, Johannesburg. The output is expected to be 1,400 gross boxes a day, with an output of 2,100 gross boxes at a later date. It is expected that the firm will find a ready sale within a radius of 200 miles from Bloemfontein, the native territories alone offering considerable scope.

The Society of Refrigeration and Air-conditioning Manufacturers, Engineers and Importers of South Africa has been formed in Johannesburg to promote, encourage and protect the interests of members engaged in the refrigeration and air-conditioning plant and equipment trades. The society intends to collect and disseminate technical information for the benefit of its members and to undertake technical education of service engineers. The secretary's address is P.O. Box 4791, Johannesburg.

The glass position in South Africa is at present worse than it has been at any time since the war broke out, but there are good prospects that supplies will improve steadily until by the latter part of 1946 the country's demands should be met with little difficulty. Before the war, supplies of plate glass, sheet glass, figured glass, wired glass, and similar glass, came almost entirely from Great Britain, Belgium and France. After war broke out, and when Belgium and France were overrun, supplies came from Britain almost exclusively, with the United States supplying small quantities of sheet glass.

During the war period, the highest priority was given to the export of cement from South Africa to the Far East for war purposes. An average of 6,000 tons monthly was despatched to Calcutta, but all contracts have now been cancelled, and ample supplies are expected to be available for South Africa's building requirements.

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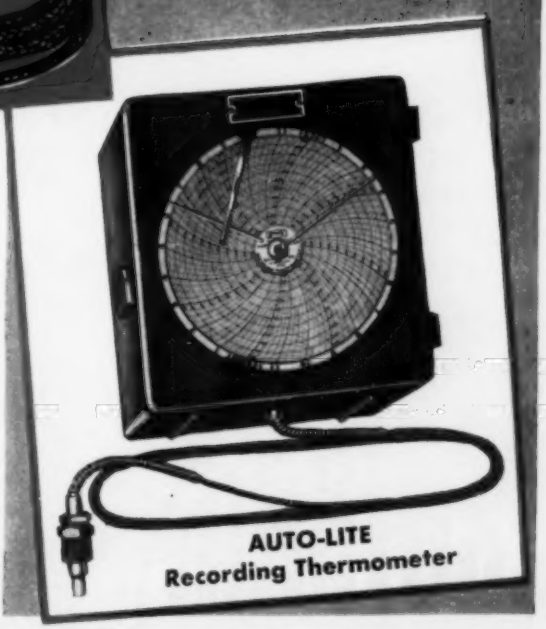


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# AUTO-LITE *Indicating and Recording* THERMOMETERS

## ARGENTINA WILL LIMIT IMPORTS TO REQUIREMENTS WHICH CANNOT BE PRODUCED BY LOCAL INDUSTRY

Special Correspondence

With conflicting rumors, much discussion of tariff changes, and quick government action, the possibility of foretelling the role to be played in Argentina in the immediate postwar years by competing foreign industries becomes particularly difficult. In the present trend of government thinking, foreign competition in most lines is to be limited to the essential minimum, supplying only those requirements which cannot satisfactorily be produced by local industry.

Future trends of the Argentine chemical industry can probably be best judged from a study of the past. While coverage of war years' activities does not give a complete picture of this industry's requirements, certain factors are outstanding.

In this connection, a series of short articles written by prominent Argentine industrialists and carried recently in the local press are highly informative. The outgrowth of a questionnaire sent to members of the Unión Industrial Argentina, these articles constitute a direct opinion of the men actually engaged in industry, and, while many of the opinions expressed are possibly purely personal views of the men concerned, the following summary of chief facts contained give a reasonably complete round-up.

Though imports of industrial chemical products were moderately regular throughout the war, shortage of raw materials handicapped local production. With the end of the war the cost of raw materials will drop considerably. Freedom of Customs duties on imports necessitates reasonably minimum protection for local industry through the removal of comparatively high duties on the raw materials used by the industries, which are now placed in an unfavorable position.

While the official Argentine foreign trade statistics for 1944 have not yet been released, the following comparative figures on imports, taken from shipping manifests, are available for the years 1944 and 1943:

**Imports of Chemicals**

Tons

| | *1944* | *1943* |
|---|---|---|
| Coal tar products .... | 324,017 | 165,387 |
| Medicinal and pharmaceutical preparations | 827,859 | 481,294 |
| Chemical specialties... | 3,386,815 | 3,455,137 |
| Industrial chemicals.. | 6,602,141 | 5,294,497 |
| Pigments; Paints and varnishes ..... | 2,914,597 | 5,472,483 |
| Fertilizers and explosives .....14,495,780 | | 40,040,656 |
| Soap and toilet preparations ..... | 82,005 | 125,551 |

The return of normal foreign trade will bring particularly keen competition to the pharmaceutical branch of the Argentine chemical industry. The kinds of competition to be faced and the new development required, are not yet clear. In view of wartime Argentine expansion in the foreign markets, other governments may decide to compete, without consideration of immediate losses, to recover markets lost by them during the war.

The prospects to the different types of

pharmaceutical products vary widely. While Argentine industry depends upon imports of raw materials for medicinal products, foreign industries are dependent upon our raw materials for other classes. While the confused issue will be cleared principally by the stand taken by foreign producers, Argentine industry is prepared to hold its foreign markets principally for those products manufactured from local raw materials. Future Customs regulations will be of great importance.

### PRICE COMPETITION

While Argentina does not have fear of competition in product quality, the same is not true regarding selling prices, production costs being considerably higher for the following reasons—small scale of manufacture; and high standard of living of the Argentine employee and workman. In those products made from local raw materials, the Argentine manufacture can successfully compete in both price and quality. Any possible loss in foreign markets may be compensated by increased expansion in the local market.

The cost of postwar replacement of stocks of chemical materials and equipment for this industry, according to a survey carried out by the Argentine Institute of Investigations and Economic Studies, is placed at slightly over 50 million pesos. This rates very low as compared with 866 millions for iron and steel, 693 million for textiles (cotton, wool, silk and linen), 550 million for jute, etc., 305 million for machinery and motors in general, 234 million for coal and petroleum, 154 million for wood and lumber and 117 million for vehicles.

With the exception of certain specialized kinds of equipment (including boilers), the machinery and spare parts required by the industrial chemicals industry may be obtained locally. Adapted to particular needs, they are not only cheaper, but may also be obtained more rapidly than imported products. The experience of war years is the best testimony to the excellent prospects of both chemical industry and the machine industry connected with it. Stock difficulties will disappear with the return of normal shipping conditions. Present trend in raw materials prices is downward. Production quality will improve with availability of better raw materials; quality may be maintained through choice of supply sources. Technical and scientific advances realized during the war in other countries will be introduced here.

The domestic demand for industrial chemicals can be met entirely by local production. Present exports are insignificant; prospective purchasers, various South American countries and South Africa.

The return of normal foreign trade will benefit the pharmaceutical industry through replacements of needed machinery, precision instruments, laboratory equipment and various other industrial requirements. It will also open other markets of the world for the export of all classes of drugs and basic raw materials.

Argentine need of machinery replacements is in many cases urgent. Local manufacturers should adopt new laboratory processes and new production methods evolved during the war. An outstanding need—technical laboratory glass equipment.

The minimum government action required by industrial chemical manufacturers is the

# Drying Processes with FW designed

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An exclusive Foster Wheeler service is design—then manufacture—of special-service heating systems. The unit illustrated shows one application of Dowtherm heating to drying rolls.

Dowtherm heating gives the unparalleled advantages of high temperature *without* high pressure. At 500 deg. F. these systems operate at atmospheric pressure, show only moderately increasing pressure up to 700 deg. F.

Construction and operation is simplified by the elimination of high pressure. Also, flexible Dowtherm heating permits a single vaporizer to maintain different temperatures in rolls arranged in series.

The Dowtherm story of liquid and vapor phase heating is told in Bulletin ID-46-3. Address any branch office, or

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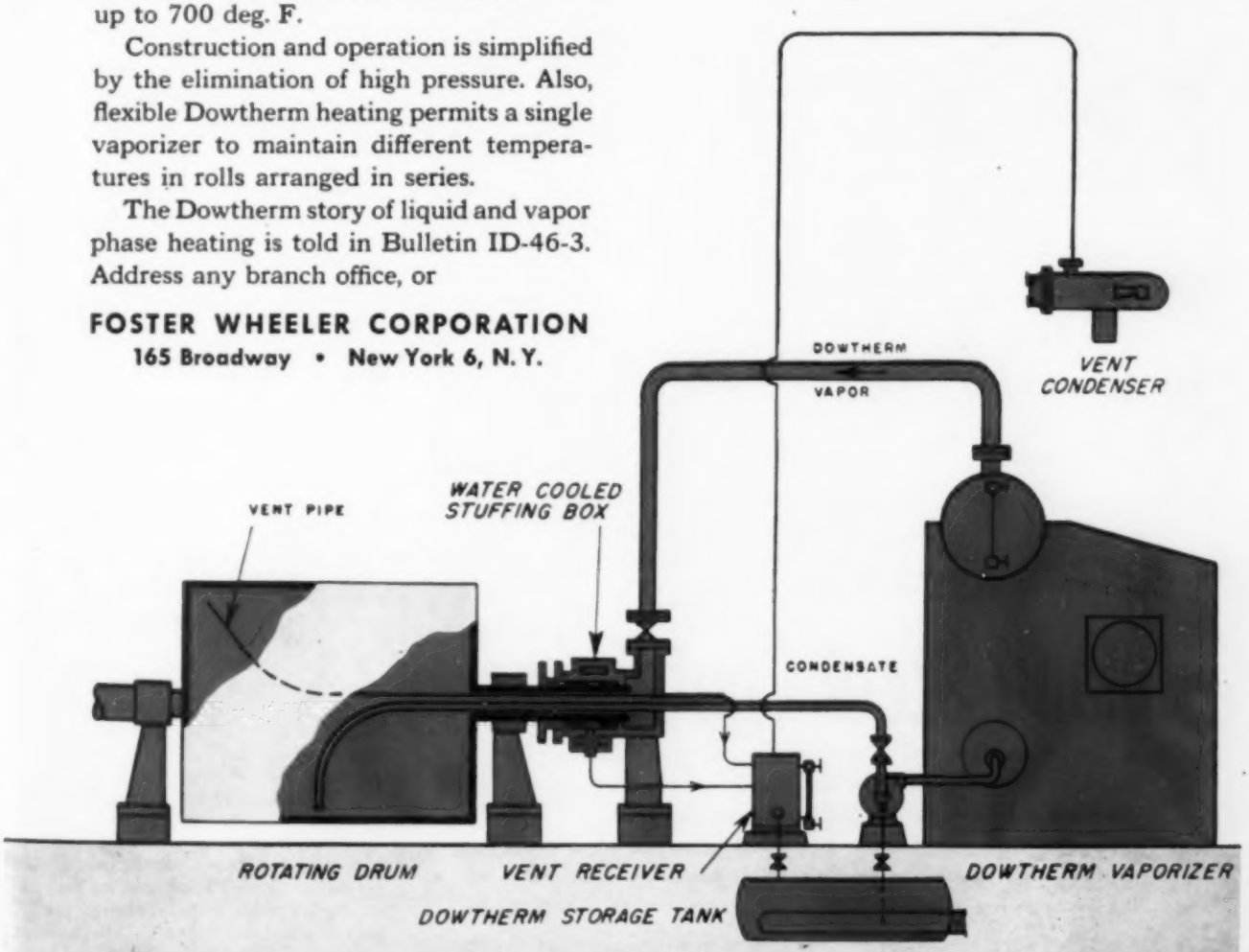


FOSTER FW WHEELER

removal of duties on raw materials not produced in the country, reducing their cost by approximately one half, and rationalization of internal and provincial taxes presently affecting locally manufactured goods only. Producers of pharmaceutical products require adjustment of Customs regulations to facilitate the importation of technical equipment and raw materials required. They advocate the placing of a protective duty on products similar to those manufactured locally.

Government industrial credit will particularly benefit the industry, with long-term credit facilitating the building of new factories and these solving the chief difficulty of this industry in former years.

While general production costs have increased as much as 100 percent, they should drop to an average of about 30 percent above prewar level. A "war baby", without competition, the industrial chemical industry's growth has not been affected by high costs. To maintain present high quality production, pharmaceutical manufacturers have two principal needs: To obtain imported raw material requirements at reasonable prices; and to hold the export market of those products manufactured from local raw material. With the return of open competition, the problem of high costs must be solved to insure the continued existence of this industry.

### INCREASED YIELDS FROM COKE IN RUSSIA

Coke plants at Magnitogorsk, Kuznetsk, and elsewhere in Russia have for the past three years been using a method of washing coal with gasoline which provides increased yields of coke and also has a favorable effect on the tar. At the Magnitogorsk ovens anthracenic oil has also been employed as a wash. Much of the technique used is similar to comparable developments in the United States, though it was developed independently by the Energy Institute of the Soviet Academy of Sciences. According to Russian scientists, the chief results so far have been:

1. Increased production of coke ovens generally runs not less than 5 percent if the charge is moistened with gasoline, and not less than 4 percent if anthracenic oil is used. For certain byproducts (the most important—toluene) output is raised by a considerably larger figure, wetting of the mass of coal acting favorably on the quality of the crude benzene.

2. The increased weight of the charge from the wetting improves the quality of tars by diminishing cracking. In this case, the concentration of phenolocresols and pyridine bases in the tar is raised. The tar's specific gravity is lowered.

3. The quality of metallurgical coke is improved.

4. The technique can be rapidly and easily installed in any sort of coke plant. It can be used with all sorts of coal and different degrees of humidity. Tables of optimum percentages of gasoline to add under different conditions have been developed.

5. The technique simplifies charging of coke ovens. Also, the washed coal generally does not freeze in winter.

Further developments of the technique are planned, particularly use of a mixture of gasoline and anthracenic oil as a wash, which

# Hooker CP-40, A New and Improved Chlorinated Paraffin

In formulations for flame and water repellency where 40% Chlorinated Paraffin may be used, here is a new and improved Hooker product. It is an exceptionally stable, light colored viscous liquid with an extremely low iron content.

Hooker specialized experience in chlorinating long chain aliphatics has resulted in the development of this improved product. CP-40 is compatible with a number of film forming resins, and may be used as a plasticizer or extender with them. Technical Data Sheet No. 731 which more completely describes CP-40 is available when requested on your company letterhead.

## Physical Properties . . . . . CP-40

| | |
|---|---|
| Chlorine Content | 42 ± 1% |
| Specific Gravity, 15.5°/15.5°C | 1.185 ± .01 |
| Viscosity at 210°F (Saybolt Universal) | 160 to 180 |
| Acidity as HCl | 0.006% max. |
| Iron | 10 ppm. max. |
| Color, Union Colorimeter ASTM | 1.5 to 2.5 |
| Thermal Stability (6 hours at 300°F) | 0.15% HCl max. |

Where the formulation calls for a 70% chlorinated paraffin, Hooker CP-70 is available for similar uses. This material is a brittle amber colored resin. It is crushed and shipped as a white powder which does not agglomerate on standing.

**HOOKER RESEARCH** *Presents*

**BENZAMIDE**

Benzamide (Amide of Benzoic Acid) is a white, free-flowing monoclinic crystalline material.
Its physical and chemical properties suggest its application in the fields of organic synthesis, including plastics, pharmaceuticals and dyestuffs. It is compatible with a limited number of resins including cellulose acetate and nitrocellulose with which it forms a firm transparent film.
For more complete information write on your letterhead for Technical Data Sheet No. 361 which lists the physical properties and a number of the reactions which Benzamide will undergo.

Because of its relative chemical inertness CP-70 is suggested also in formulations for fireproof paints, adhesives, linoleum, etc. In protective coatings and paints it does not adversely affect the rate of drying. Technical Data Sheet No. 763, describing more fully the properties of this chemical, is available when requested on your company letterhead.

## Physical Properties . . . . . CP-70

| | |
|---|---|
| Analysis (typical) | |
| Chlorine | 69 to 73% |
| Free HCl | 0.05 max. |
| Iron | 0.01 max. |
| Softening Range | 90°to 100°C |
| Acid Number, mg. KOH/gm | 0.50 max. |

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**Paradichlorbenzene** **Chlorine** **Sodium Sulfhydrate**

**HOOKER CHEMICALS**

8318

considerably increases the weight of the coal. Addition of a small quantity of solid hydrophils (for example, $C_aO$) in the wash is also planned. The washing technique may also be extended generally to prevent freezing of coal, and it will allow an increase in the number of types of coal which can be coked.

Chiefly responsible for devising this washing technique is A. Agroskine, of the Krijijanovski Energy Institute, of the USSR Academy of Sciences. His paper in "*Comptes Rendus de l'Academie des Sciences de l'URSS*, vol. *XLIX*, No. 4, Nov. 10, 1945, gives a description of his results.

## CONSOLIDATED MINING BUYS CANADIAN NITRATE PLANTS

PURCHASE of two nitrate plants from the Dominion Government for $7,500,000 has been completed by the Consolidated Mining & Smelting Co. of Canada, Ltd. One plant is located at Trail and the other at Calgary. The Trail plant was constructed for the government by Consolidated and the Calgary plant was operated under Consolidated supervision during the war period. Both plants were built to produce explosives and have since converted to the production of nitrate fertilizers. Announcement of the sale was made by C. D. Howe, Minister of Reconstruction and confirmed by R. E. Stavert, president of Consolidated who said the company intends to maintain full production at both plants.

## EXPORTS FROM BRAZIL MADE NEW RECORD LAST YEAR

FIGURES just released by the Brazilian Government indicate that export trade did not fall off after the end of the war and the active demand for Brazilian goods is said to be continuing. Exports in 1945 reached the record-breaking figure of Cr$12,197,510,000 or $609,875,500. The volume of exports also showed a good increase the totals being 2,671,405 tons in 1944 and 3,027,221 in 1945. Nearly 50 percent by value were destined for the United States or 46 percent of the total volume. Coffee beans, cotton textiles, and raw cotton were the leading commodities exported but other shipments included 150,447 tons of castor beans, 18,887 tons of rubber, 9,432 tons of carnauba wax, and 476 tons of menthol. Cottonseed oil exports almost tripled in value over 1944 and babassu nuts registered the most sensational rise in the oil-bearing nut field, jumping from a value of $793,150 in 1944 to $4,488,850 in 1945.

## ITALY INCREASES OUTPUTS OF ASBESTOS AND TALC

ITALY'S asbestos mines are reported to be in a position to step up production considerably provided demand for export increases. During the third quarter of 1945, period for which latest figures are available, average monthly production of 360 tons was sufficient to meet domestic demands. This included 350 tons of short fiber asbestos and 10 tons of long. Average monthly production in 1938 was 550 tons of short fiber and 18 tons of long.

During the third quarter of 1945, pro-

duction of talc had reached a monthly average of between 1,000 and 1,200 tons compared with 4,250 tons in 1938. Increased production of talc also is held to be contingent on increased demand for exports.

### HOLLAND MAY PRODUCE SYNTHETIC RUBBER

In a report from Amsterdam, the McGraw-Hill World News Bureau states that the Dutch government has appointed a commission to investigate the possibility of making synthetic rubber and plastics domestically. One member of the commission is now in the United States, studying American technique in these fields.

Meanwhile, all Dutch superphosphate factories have been back in operation since last November, and the Royal Sulphuric Acid Factory is working up to normal capacity.

### SWEDEN USES EXCELSIOR AS BUILDING MATERIAL

A means of saving wood in house construction, substituting for it compressed excelsior, is presented by a new method now being tried out in Sweden at a prefabricated house building plant. The excelsior is impregnated with certain chemicals, later mixed with cement, and then pressed into a mold formed by the wooden studs. The compressed material forms the curtain wall and at the same time acts as thermal insulation, having an efficiency said to be 300 percent better than that of wood alone. The method offers possible cost savings of 15 percent, as well as appreciably reducing the weight of the wall construction.

### LONG-TERM PLAN FOR INDIAN DYESTUFF DEVELOPMENT

A new 20-year plan for the establishment of an independent Indian dyestuff industry, capable of producing all the dyes in substantial demand in the country together with all the necessary intermediates, is proposed in the report of the Dyestuffs Exploratory Committee of the Indian Board of Scientific and Industrial Research. Such a program, it is estimated, would cost approximately $75,000,000.

The plan would comprise three stages: (1) manufacture of 51 basic synthetic dyes and some of the intermediates within a five-year period; (2) production of all the intermediates required for these 51 basic dyes within 10 years; (3) production of all the dyes in substantial demand in the country, plus all necessary intermediates, within 15-20 years.

Citing the importance of the dyestuffs industry to India's economy, the report asserted: "Unless a country is self-sufficient in this vital matter, its economic development is stunted in peace and liable to be seriously impaired in war."

### SOUTH AFRICAN UNIVERSITY SEEKS CATALOGS

Courses in chemical technology have been established in Natal University College, Durban, Union of South Africa, and the department of chemistry and chemical technology would like to receive catalogs

ORONITE CHEMICALS

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THE NAME TO WATCH IN CHEMICALS

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| | No. 8 | No. 12 | No. 16 | No. 20 | No. 24 | No. 32 | No. 64 |
|---|---|---|---|---|---|---|---|
| Flash Point, Clev. °F. | 315 | 340 | 360 | 380 | 435 | 500 | 540 |
| Viscosity 100° F. SSU | 358 | 3390 | 5425 | 17160 | 49750 | 167500 | 347600 |
| Viscosity 210° F. SSU | 52 | 154 | 210 | 528 | 1060 | 3065 | 6075 |
| Viscosity Index | 71 | 75 | 80 | 100 | 104 | 115 | 119 |
| Pour Point °F. | —30 | —5 | 0 | 10 | 20 | 40 | 55 |
| Solid Point °F. | —35 | —10 | —5 | 5 | 15 | 35 | 50 |
| Gravity, API | 35.4 | 32.0 | 31.0 | 29.8 | 27.9 | 26.0 | 25.0 |
| Spec. Gravity | .8478 | .8654 | .8708 | .8772 | .8877 | .8984 | .9042 |
| Lbs. Per Gallon | 7.059 | 7.206 | 7.251 | 7.305 | 7.392 | 7.481 | 7.529 |
| Molecular Weight | 370 | 530 | 600 | 700 | 900 | 1200 | 1500 |
| Neut. Number | .10 | .10 | .10 | .05 | .02 | .01 | .01 |
| Sap. Number | .3 | .3 | .2 | .2 | .2 | .1 | .1 |
| Carbon % | 0 | 0 | 0 | 0 | 0 | .01 | .02 |
| Sulphur % | .01 | .01 | .01 | .02 | .02 | .02 | .04 |
| Sligh Oxidation Test | 0 | 0 | 0 | 0 | 1 | 1 | 2 |
| Color ASTM (Max.) | 1½ | 1½ | 1½ | 2 | 2 | 2 | 2 |
| Dielectric Strength | 35,000 | 35,000 | 35,000 | 35,000 | 35,000 | 35,000 | 35,000 |

# ORONITE CHEMICAL COMPANY

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and manufacturers publications from companies in the United States. The course is intended to train students for responsible positions in the growing chemical industry in the Province of Natal and such publications would be of great assistance in this training.

### GAS REFORMING PLANT FOR TOULOUSE, FRANCE

CONTRACT has been awarded by Office National de l'Azote of France for a gas reforming plant to be erected in Toulouse, France, on the Garonne River. The contract was given to Chemical Construction Corp., New York, and this company will design the plant and furnish the materials for construction and the equipment. The plant will use the methane steam process and convert natural gas, by high temperature cracking, into hydrogen and nitrogen for use in the synthesis of ammonia. It will have a charging capacity of about 20 million cubic feet of natural gas daily.

### CHEMICAL PRODUCTION IN JAPAN AT LOW LEVEL

BASIC heavy chemicals are being produced in Japan at the rate of about 19 percent of plant capacity, yielding only 14 percent of estimated minimum requirements, according to a recent report issued by the General Headquarters of the Supreme Commander for the Allied Powers. Fertilizer production is closest to capacity, but still falls far short of demand. Critically-needed salt also continues to be in short supply by reason of the coal shortage and typhoon damage.

Only one of four Solvay process soda ash plants was in operation at the beginning of this year, and production has been further restricted on account of an unfavorable price for the product. This latter factor may be somewhat relieved by the recent increase to 5,000 yen per metric ton. Caustic soda production, particularly by the electrolytic process, is very low.

Ethyl alcohol, produced by the fermentation of critically-important foods like sweet potatoes and corn, is being distilled in quantities nearly sufficient for immediate medical and industrial needs. Coke by-products are negligible, as the small allocations of coal are being used simply to heat the ovens and prevent the consequences of complete shutdown.

### COKE INDUSTRY IN POLAND SLOWED BY LACK OF MARKETS

THE OUTPUT of the 20 coking plants operating in Poland at the end of last year was approximately one-third of capacity. The slowing up is due to the lack of demand for coke products and to a shortage of transportation facilities. Normal production is about 5,698,018 metric tons of coke, 815,000,000 cubic meters of gas, 221,000 tons of tar, 57,000 tons of sulphate of ammonia, and 77,000 tons of benzol. Despite the reduced production, stocks continued to increase with the possibility that further reductions in output would be necessary. Unless the output of pig iron and steel can be increased in a relatively short time, export markets must be found to keep the coke plants in operation.

# GERMAN CHEMICAL INDUSTRIES

## CERAMIC MATERIALS

In order to reduce the size of capacitors and other electrical equipment, high dielectric constant materials have been worked on by all the ceramic companies.

High dielectric constants, high permeability, high or low insulation, plus as well as negative temperature coefficients have been worked on intensively by Dr. Franz Rother of Lutz & Co. Likewise a relatively high degree of flexibility is accomplished; very thin sheets which can stand fair handling have been made and the materials may be cast and baked in fairly complicated forms. Perhaps the reason for these successes lies in compact mixing, grinding and filtering.

For the high dielectric constant materials, titanium dioxide is the basic constituent in one or the other of its different crystalline formations. Two sample formulations are:

Composition 964

| | |
|---|---|
| Rutile | 69 parts |
| Titanium dioxide | 10 |
| Lanthanum oxide hydrate | 10 |
| Zirconium hydrate | 10 |
| Beryllium carbonate | 1 |

Composition 336

| | |
|---|---|
| Rutile-oxide | 97 parts |
| Lanthanum oxide hydrate | 1 |
| Zirconium hydrate | 2 |

Dielectric constants ($K$) of these two materials are 90 and 105 respectively with temperature coefficients of $-7 \times 10^{-4}$ per deg. C.

Formula for a ceramic with a $K$ of 405 and a positive temperature coefficient of $1.8 \times 10^{-3}$ is:

| | |
|---|---|
| Titanium dioxide | 70 parts |
| Rutile | 10 |
| Titanium peroxide | 13 |
| Lanthanum oxide hydrate | 7 |

High permeability materials with high electrical conductivity:

| | |
|---|---|
| Ferric oxide $Fe_2O_3$ | 80 parts |
| Soapstone | 15 |
| Magnesium carbonate | 5 |

This material has a higher conductivity in the center than the outside. Conductivity of the entire piece can be raised by baking in nitrogen, thus reducing oxidation.

In producing these various ceramic materials, the raw materials in finely pulverized form, are weighed, mixed and tipped into revolving drums. Each drum contains about 1/3 flintstone, 1/3 of the mixture and 1/3 water. Quantity of water is measured so that about 2.5 liters is allowed for each 2 kg. of mixture. Water and mixture are milled for about 100 hr. Interior walls of the drum may be lined with porcelain or flintstone.

After the milling process is completed the mixture is passed through a fine sieve into a vat fitted with a propeller-shaped whirl. The whirl is kept in constant motion and the mixture pumped into a filter press at a pressure of 8 atm.

Cakes of substance emerging from the press are passed along to a roller device and reduced to small pieces which are once more passed through different sieves of varying

mesh. It can then be pressed again into cakes and once more finely divided in the chopper. The final dimensions of the grains depend to a great extent on the nature of the objects to be made and also on the nature of the matrix used. The powder is then subjected to the ordinary processes of pottery.

For those masses with a high dielectric constant and low loss angle, the process of the ordinary tunnel kiln will serve satisfactorily. According to the size and strength of the objects, they will remain at a temperature of up to 1,400 deg. C. for periods of from 10 to 75 hr.

For adding the quality of permeability the operations are exactly the same. According to the value desired, the firing takes place in a reducing or an oxidizing atmosphere. For a reducing atmosphere it will suffice if further access is denied to air or, alternatively, if a hydrogen atmosphere is introduced.

Digest from "Report on Ceramic Developments of Dr. Rother, Lutz & Co., Lauf/Pegnitz," by R. H. Ranger.

### PAINTS MADE WITHOUT DRYING OILS

Etablissements Alphonse Wyns is a paint manufacturing concern with factories in Belgium and France. During the occupation period they gave great attention to the question of making paints and enamels without or with minimum quantities of drying oils. The firm tried to substitute drying oils in paint by the use of the residual gums obtained from the distillation of crude benzol, and of light tar oils. These residual gums are partly polymerized resins of the coumarone-indene type. Three types of tar-oil distillation residues are called resinol, resigum and resilin.

Resinol is a liquid obtained by the distillation of the heavier fractions of the benzolated oils obtained by scrubbing coke oven gas.

Resigum is the final residue of the distillation of tar oil benzol which has been washed with sulphuric acid, water, caustic soda, and again with water. The residual gum should contain as little as possible of oils distilling below 250 deg. C. but its exact composition depends on the type of coal employed, the temperature of carbonization and the method of benzol recovery. A fairly standard type of resigum was desirable and rather exact laboratory control of incoming samples was necessary if very variable resigums were obtained. The lowest possible content of water and of naphthalene was arrived at. Factory specification for resigum for incorporation in paints was a maximum water-content of 1 percent and a maximum naphthalene content of 5 percent. The resigum must also have a neutral reaction and must give a transparent film when spread on glass.

The third useful residual resin from tar oils is known as resilin. This is the resin recovered from washing benzol with sulphuric acid. This residue, which precipitates in the washing acid, is an acidic mixture of a resin of the coumarone-indene type with sulphonated oils. This residue can be neutralized with caustic soda and the solid resin obtained can be dissolved in resinol to make a drying oil for paints. It

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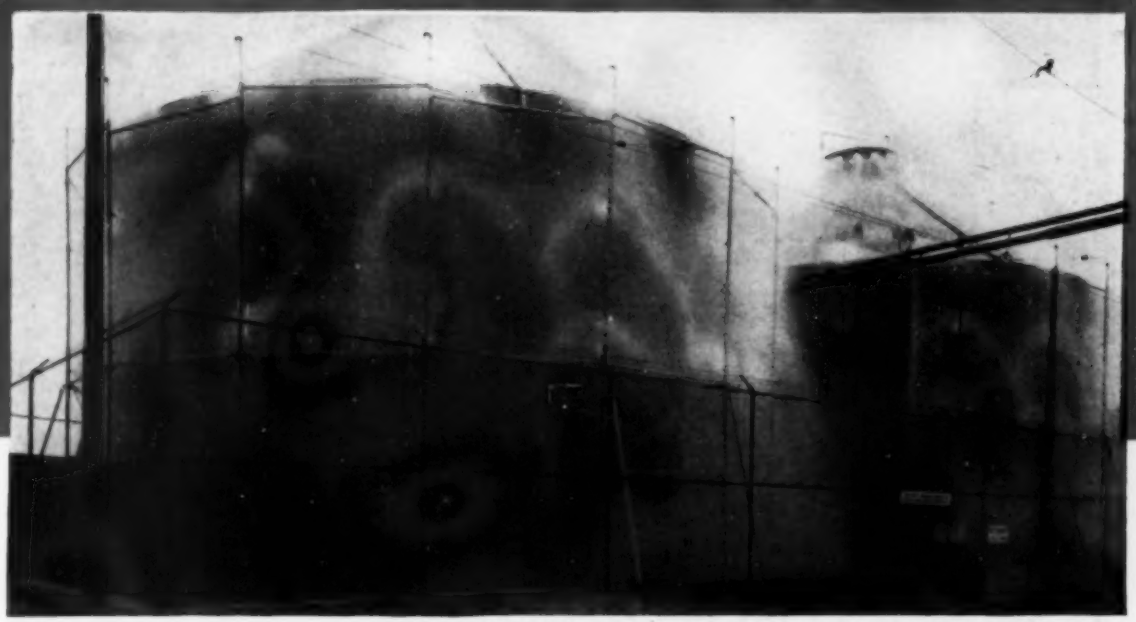

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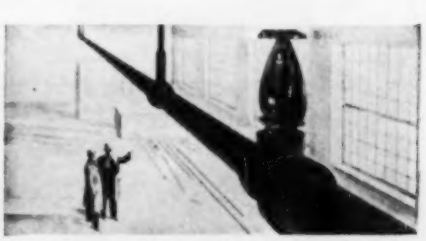

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appears, however, that resigum is a more satisfactory product than the solution of resilin in resinol.

Resigum is completely miscible with mineral, animal and vegetable oils and with natural resins such as gum copal and colophony and with glyptals and phenolic resins.

Paints can be made with resigum without any addition of natural drying oil whatsoever. It is not claimed that such paints give as good a finish as normal paints. It is claimed that these paints nevertheless give good coverage and surface protection. The film given by resigum paint was highly flexible. It is admitted that paints in which some natural drying oil is incorporated in addition to resigum are much superior in finish to those containing resigum only.

Digest from "Paint Manufacture—Etablissements Alphonse Wyns, Vilvorde," by H. J. Phelts.

## ALUMINA FROM COAL ASHES

Two commercial plants to operate the Seailles-Dyckerhoff process for recovery of alumina from coal ashes were established during the war. Though technically the process was found practicable it was quite uneconomic with materials of such low alumina content as those used.

Essentially the process consists of burning an alumina-containing raw material with limestone; extracting the pulverized material with water by a countercurrent method; precipitating the alumina and lime from this solution by treatment with carbon dioxide and then subsequently extracting the alumina from the mix of these two solids by treatment with soda. An alternative procedure for the extraction is to treat the burned material with a sodium carbonate solution.

The object of establishing these plants in Germany was to produce alumina from indigenous raw materials. Both clay and colliery wastes were tested in the preliminary trials, but eventually it was decided to work on power station ashes as the raw material, selecting ashes with as high an alumina and as low a silica content as was possible. The raw mix of ashes and limestone was treated as in portland cement manufacture and burned in a rotary kiln with a reducing atmosphere to obtain the great bulk of the iron either as FeO or as metallic iron. The temperature of burning was about 1,300 deg. C. and the air flow through the cooler was reduced to give slow cooling and obtain a self-pulverizing clinker. The lime content of the raw mix was calculated as that required to form $2CaO.SiO_2 + CaO.Al_2O_3$ with about 10 percent excess. No allowance was made for iron oxide in the proportioning. A clinker of this composition should be self-pulverizing on slow cooling, and indeed, unless the clinker did self-pulverize, it was found that the alumina content which could subsequently be extracted was reduced. For 1 ton of alumina some 10-12 tons of ashes (25-30 percent alumina) and 15 tons of $CaCO_3$ were required. The clinker contained about 13-14 percent alumina and from 60-70 percent of this could be extracted by the sodium carbonate method. The self-pulverized clinker was treated with a sodium carbonate solution in a mixer from which both solution and solids passed to a

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sedimentation tank or thickener. The mud which settled out in this thickener was passed to rotary vacuum filters and then used for manufacture of portland cement. The solution from the thickener was passed through filter presses and then precipitated by treatment with carbon dioxide. For this purpose the kiln gases were used but this led to some difficulty in plant operation and maintenance. The gases were first washed to remove dust and the wet gases containing sulphur dioxide caused trouble by corrosion of the pipelines. The solution obtained from the precipitator was returned to the circuit.

Digest from "Sealiles-Dyckerhoff Alumina Process, Portlandzement Fabrik Dyckerhoff & Sohne at Amoneburg Bei Biebrich," by F. M. Lea.

### THERMOCOLOR PAINTS

HEAT-SENSITIVE metallic salts or pigments are a convenient method for measuring approximate temperatures on large surfaces such as boilers, dryers, furnaces, etc. Compounds of cadmium, cobalt, nickel, copper and manganese, in combination with other pigments and a suitable binding medium are useful for this purpose. Standard crayons or marking colors have been calibrated against time and temperature. Marking paints in which the color has been dispersed in urea-formaldehyde resin solution have been prepared. A few examples are tabulated below.

Digest from "Report on Thermocolour Paints, I. G. Farbenindustrie, Oppau (Ammoniaklaboratorium)," by V. C. Bidlack.

**Color Changes in Thermocolor Paints**

| Code | Color Change | Time vs. Temperature* 10 | 30 | 60 | 90 | 120 |
|---|---|---|---|---|---|---|
| F36b | yellow—red brown | 300 | 290 | 280 | 270 | 260 |
| F214 | purple—blue | 150 | 140 | 137 | 133 | 130 |
| F217 | green—brown | 230 | 220 | 210 | 200 | 195 |
| F318 | lt. red—lt. blue | 72 | 65 | 62 | 60 | 58 |
| F318 | lt. blue beige | 155 | 145 | 135 | 130 | 125 |
| F320 | grey-green—lt. blue | 72 | 65 | 62 | 60 | 58 |
| F320 | lt. blue—olive gn. | 155 | 145 | 135 | 130 | 125 |
| F320 | olive gn.—brown | 230 | 220 | 210 | 200 | 195 |
| F333 | yellow—violet | 120 | 110 | 105 | 103 | 100 |
| F334 | lt. green—blue | 63 | 60 | 55 | 52 | 50 |
| F335 | red—blue | 40 | 38 | 36 | 34 | 33 |

* Minutes vs. temperature, presumably deg. C.

**Composition of the Paints**

| Code | Formula |
|---|---|
| F36b | 7 kg. Ferrite yellow<br>3½ kg. Plastopal* |
| F214 | 10 kg. $CoNH_4PO_4.H_2O$<br>2.3 kg. Plastopal |
| F217 | 7 kg. $CuSO_4.3Cu(OH)_2.H_2O$ |
| F318 | 3.75 kg. $MgNH_4PO_4.6H_2O$<br>1.25 kg. $CoNH_4PO_4.6H_2O$<br>2.5 kg. $Pb(OH)_2$<br>2.2 kg. Plastopal |
| F320 | 4.5 kg. $MgNH_4PO_4.6H_2O$<br>1.5 kg. $CoNH_4PO_4.6H_2O$<br>4.2 kg. $Pb(OH)_2$<br>2.8 kg. $CuSO_4.3Cu(OH)_2.H_2O$<br>4.5 kg. Plastopal |
| F333 | 4 kg. $NiCl_2.2C_6H_{12}N_4.2H_2O$<br>2 kg. $TiO_2$<br>2.5 kg. Plastopal |
| F334 | 4 kg. $NiBr_2.2C_6H_{12}N_4.10H_2O$<br>2 kg. $TiO_2$<br>2.5 kg. Plastopal |
| F335 | 4 kg. $CoCl_2.2C_6H_{12}N_4.10H_2O$<br>2 kg. $TiO_2$<br>2 kg. Plastopal |

* Plastopal is a 50 percent solution of urea-formaldehyde resin in butyl alcohol. To obtain spraying or brushing consistency, products are reduced with ethyl alcohol—usually 100 parts color paste to 60 or 80 parts alcohol.

# N.A.C.E. Convention

More than 500 corrosionists from all parts of the country gathered in Kansas City, Mo., on May 7, 8 and 9 to attend the annual convention and exposition of the National Association of Corrosion Engineers. This was the Association's second national meeting and its first exposition of manufacturers' products. There was no question of the meeting's success; NACE has established its place among the national engineering societies.

### COURSE PLOTTED

During the course of the convention the Association held a symposium to determine what line of activity it might best follow to supplement, and not overlap, the corrosion activities of other technical societies. Representatives of 14 societies explained how their respective organizations handled corrosion and on the basis of these reports the broad outlines of NACE's future were sketched in. Inasmuch as NACE is almost certainly destined to assume increasing importance, and perhaps become the central figure in the battle against corrosion, it would be a mistake not to take stock of the way in which the Association will probably shape up.

The fact that the meeting was attended by a surprisingly large number of the country's top corrosion workers is evidence enough that NACE has been received as a welcome approach to a real problem—namely, the problem of fostering inter-industry cooperation in attacking an inter-industry phenomenon. As now constituted, technical societies are generally related to a particular branch of science (American Chemical Society), or a special phase of engineering (American Society of Mechanical Engineers), or to a particular industry (American Petroleum Institute). Corrosion, however, is no respecter of such vertical classifications; in many of its aspects it is a horizontal phenomenon and very frequently information developed by one group of scientists or engineers bears directly on the problems of another.

That is where NACE fits in. By-and-large its members are also associated with one or another of these other organizations. NACE plays the role of the common meeting ground, the open forum, whereby knowledge gained in one industry can be made more immediately available to those concerned with a similar problem in another industry. As such, it performs a unique and much needed function.

In addition to serving as a medium of exchange, NACE may also be expected to initiate investigations of its own. It is recognized, however, that such investigations should ordinarily be concerned with problems that are distinctly inter-industry in character. If a corrosion problem is peculiar to a certain industry, it can probably be handled most effectively by an industry association; if the problem extends to many industries then it comes within the proper scope of NACE. For example, corrosion by refrigerants probably represents a special problem for the American Society of Refrigerating Engineers, whereas corrosion by the fluid being cooled is a general problem for NACE. It is recognized also that NACE, as its name implies, may properly be expected to devote itself primarily to the practical, or engineering, aspects of corrosion. In this way it should serve to supplement and utilize the work of the corrosion division of the Electrochemical Society—a group that seems likely to devote a good deal of attention to the fundamental principles involved in corrosion.

It was also the concensus of opinion that NACE should not attempt any activities that have already become the well established function of some other organization—even though such activities might be considered within the province of NACE in that they are inter-industry in scope and of a practical engineering character. For example, the American Society for Testing Materials has been very active in developing corrosion testing methods and their correlation with performance; its testing methods frequently form parts of specifications. Since ASTM is so well established and so well organized to handle this kind of work, any duplication of such activities by NACE would probably be undesirable.

### CORROSION ABSTRACTS

NACE, it was announced at the Kansas City meeting, has taken steps to relieve one of the major causes for complaint among corrosion workers, namely, the lack of any comprehensive abstracting service for current corrosion literature. With the help of the American Coordinating Committee on Corrosion, NACE plans to prepare such abstracts and publish them regularly in the Association's quarterly journal *Corrosion*. Abstracts will be so arranged and coded as to facilitate the preparation of bibliographies on particular topics, and every effort will be made to make the service as nearly complete as possible, the ultimate object being to include abstracts of all worthwhile domestic and foreign articles. In addition it is hoped that it will be possible to publish in *Corrosion* complete copies or extensive abstracts of papers on corrosion that may be presented before other technical societies.

### OPEN MIND

One of the most optimistic signs to be seen at the recent convention was the evidence of the Association's breadth of interest. NACE was founded by a group of engineers from the petroleum industry, and although it aspired to embrace all industry, it was inevitable that during its first year or two it should assume the complexion of a petroleum-industry association, both in its membership and its papers. However, the group has continued its effort to attract corrosion engineers from other industries, and judging from the number of non-petroleum engineers present it is on its way to success in establishing itself as a truly inter-industry association. For example, in addition to symposiums on the oil and the natural gas industries, the program also included symposiums on corrosion in the water industry, the electrical and communication industries, and the chemical industry. It is probably true that petroleum still predominates but the Association is by no means tied to its apron strings. NACE is turning more and more to other industries; conversely, and equally important, an increasing number of corrosion engineers from other industries are coming to take an interest in the affairs of NACE.

### EXPOSITION

Concurrently with its technical program NACE sponsored an exposition in which thirty-odd manufacturers displayed products employed in the mitigation of corrosion. Protective coatings and cathodic protection got by far the biggest play.

*Protective Coatings*—A majority of the protective coating exhibitors were concerned with protection of underground pipelines. Owens-Corning Fiberglas Corp. showed the Fiberglas mat used as underground pipe wrapping. The Tapecoat Co. showed the tape it makes by coating cotton fabric with low-melting coal tar; it is used for hand wrapping in the field, particularly across welded pipe joints. Hill, Hubbell Div. of General Paint Corp., featured its mill-coated steel pipe and Pipe Line Service Corp., Franklin Park, Ill., demonstrated its readiness to do the work of coating and wrapping to customer specifications. Coal tar enamels were recommended in the displays of both the Barrett Div. of Allied Chemical and Dye Corp. and the Reilly Tar & Chemical Co.; bituminous coatings were featured by Wailes Dove-Hermiston Corp. of Westfield, N. J. The largest items in the exposition were a Johns-Manville pipe coating and wrapping machine and a C-R-C pipe cleaning and priming machine, both in the booth of Crutcher-Rolfs-Cummings.

A new electronic holiday detector was in-

troduced at the exposition by the D. E. Stearns Co., Shreveport, Pa.; the detector, which weighs only 45 lb., runs on rubber rollers that can be adjusted to fit any size pipe and it consists essentially of a 6-v., three-cell storage battery, an oscillatory surge generator, and a rolling coilspring exploring electrode that loops around the pipe. The generator maintains an 8,000-v. potential between the electrode and the steel pipe; if the electrode rolls over a fault in the coating the circuit is completed and an alarm given. The Nox-Rust Chemical Corp. of Chicago showed an aluminum paint, an inhibited acid rust remover, and a cold-brushable petroleum base pipe coating. Dearborn Chemical Co., Chicago, featured its line of No-Oxid petroleum wax coatings and two of its No-Oxidized wrappers, one made by impregnating asbestos with the wax and the other, for export shipping, made by impregnating cotton cloth with cellulose acetate and wax and laminating it to cellulose acetate film. Corrosite, a comparatively new protective coating, was displayed by Baker Synthetics, Inc., New York; Corrosite is a blend of thermoplastic and thermosetting resins dissolved in high-boiling solvents. Amercoat vinyl-base paint and sheeting were shown by American Pipe and Construction Co. of South Gate, Calif., and both phenolic and vinyl base coatings were featured by the Lithgow Corp., of Chicago. United Chromium Co., New York, offered phenolic and vinyl coatings and a treating solution for anodically producing a chromate film on zinc and zinc coated parts.

*Cathodic Protection*—Aluminum, magnesium, and zinc sacrificial anodes for cathodic protection were shown by Apex Smelting Corp., Chicago, and magnesium anodes by Dow Chemical Co. Several manufacturers featured products used in cathodic protection by the method of impressed d.c. voltage. General Electric Co. exhibited Tungar rectifier bulbs and copper-oxide rectifier stacks. Copper-oxide rectifier units complete with multistep transformer and rectifier stacks were featured by Westinghouse Electric Corp. and by Graybar Electric Co. Graybar also had a variety of accessory equipment for cathodic protection, such as their new mechanical connectors for attaching leads to sacrificial anodes. Federal Telephone and Radio Corp. had several selenium rectifiers on display and Jacobs Wind Electric Co. of Minneapolis, a model of the windmill d.c. generator it has developed for cathodic protection of pipelines. Another model was shown by Electro Rust-Proofing Co., this one of a d.c. cathodic protection installation in an overhead water tank.

*Miscellaneous*—The U. S. Stoneware Co. showed acid and alkali resistant brick and cement, phenolic and furan paints, stoneware valves, Tygon (vinyl-base plastic) sheet, and some accessories for hooking up Tygon tubing, namely, a new fingertwist coupling, a Y-fitting, and a wall clamp. The company also exhibited a length of 3-in. porous ceramic pipe pressure-impregnated with Duralon, a furan resin. This impregnated porous ceramic ware was developed to get resistance to thermal shock and is said to withstand a water quench from 400 deg. F.

Johns-Manville Sales Corp. displayed Transite pipe fittings for oil field service and Illinois Electric Porcelain Co. showed

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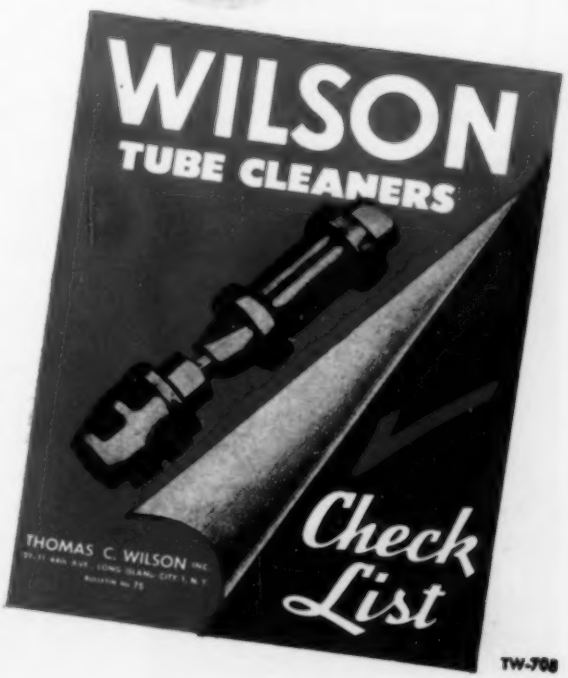



TW-708

porcelain pipe, valves, and fittings. The Cooper-Bessemer Corp., Mount Vernon, Ohio, had on display some of the corrosion resistant materials that go into the construction of the company's engines and compressors. These included: A hollow piston rod coated on the inside with a baked phenolic resin to protect against corrosion by cooling water; a diesel engine valve spring also protected by a phenolic coating; exhaust valves with the stems made of an alloy containing 18 percent Cr, 14 Ni, and 3 Mo and the head made of a precipitation hardening steel containing 24 percent Cr, 5 Ni, and 3 Mo; and an unloader valve and seat made of stainless steel containing 35 percent Ni and 15 Cr.

A metallizing gun and several metal sprayed objects were exhibited by the Metallizing Co. of America. The Aluminum Co. of America featured its Alcoa 3S condenser tubing and the International Nickel Co., an assortment of pump and valve parts, packing, metal gaskets and tubing made of nickel, Monel, Inconel and other nickel-bearing alloys.

One of the most interesting products presented at the exposition was the Probolog of the Shell Development Co. This is a device for nondestructive detection of corrosion in heat exchanger tubes; it records quantitatively all irregularities in any nonmagnetic metal tube. It consists of a probe on the end of a cable, a probe puller, and an electronic strip recorder synchronized with the puller. Each tube is tested individually without being removed from the heat exchanger. The probe is simply pulled through the tube and any irregularity in the tube wall shows up on the tape as a deflection from a centerline.

## CORROSION LITERATURE

**A Theory of the Mechanism of Rusting of Low Alloy Steels in the Atmosphere.** H. R. Copson, American Society for Testing Materials, preprint 25, 1945:—Propounds a new theory of the mechanism of rusting and concludes that corrosion rate depends on quality and quantity of water reaching steel surface. Based on the character of rust formed on low alloy steels.

**Corrosion Fatigue Properties of Some Hard Lead Alloys in Sulphuric Acid.** D. J. Mack, American Society for Testing Materials, preprint 32, 1945:—Describes an investigation of corrosion fatigue as it affects storage battery grids.

**Inhibitors of Sulphate-Reducing Bacteria by Dyestuffs.** T. H. Rogers, *Journal* Society of Chemical Industries, Oct. 1945, pp. 292–295:—Practical applications in cable storage tanks and gas holders.

**Corrosion of Equipment in High Pressure Gas Wells.** T. S. Bacon, *Gas Age*, Oct. 18, 1945, pp. 64–65:—A review of the phenomenon—where it has occurred, some of its idiosyncracies, and what is being done to investigate and prevent it.

**German Stainless Steels.** A. L. Feild, *Iron Age*, Dec. 20, 1945, pp. 60–67:—Gives properties, applications, and methods of processing and heat treating various types of stainless steels and high temperature alloys commercially produced in Germany during the war.

**Throwing Power of Anodizing Baths.** Robert S. Herwig and Albert Leigh, *Iron Age*, Dec. 20, 1945, pp. 51–53:—Device described for determining visually, especially in the case of blind holes and crevices, the degree of corrosion protection afforded by anodizing baths. It can also be applied to measure throwing power of plating baths.

**Laboratory Corrosion Tests of Rotary Lime Kiln Refractories.** G. R. Pole and A. W. Beinlich, American Ceramic Society *Journal*, Dec. 1, 1945, pp. 357–360.

**Valve Facing Alloy Resists Corrosion at High Temperatures.** V. C. Young, *Materials and Methods*, Dec. 1945, pp. 1744–1745:—Describes the satisfactory performance of the alloy at temperatures over 1,200 deg. F.

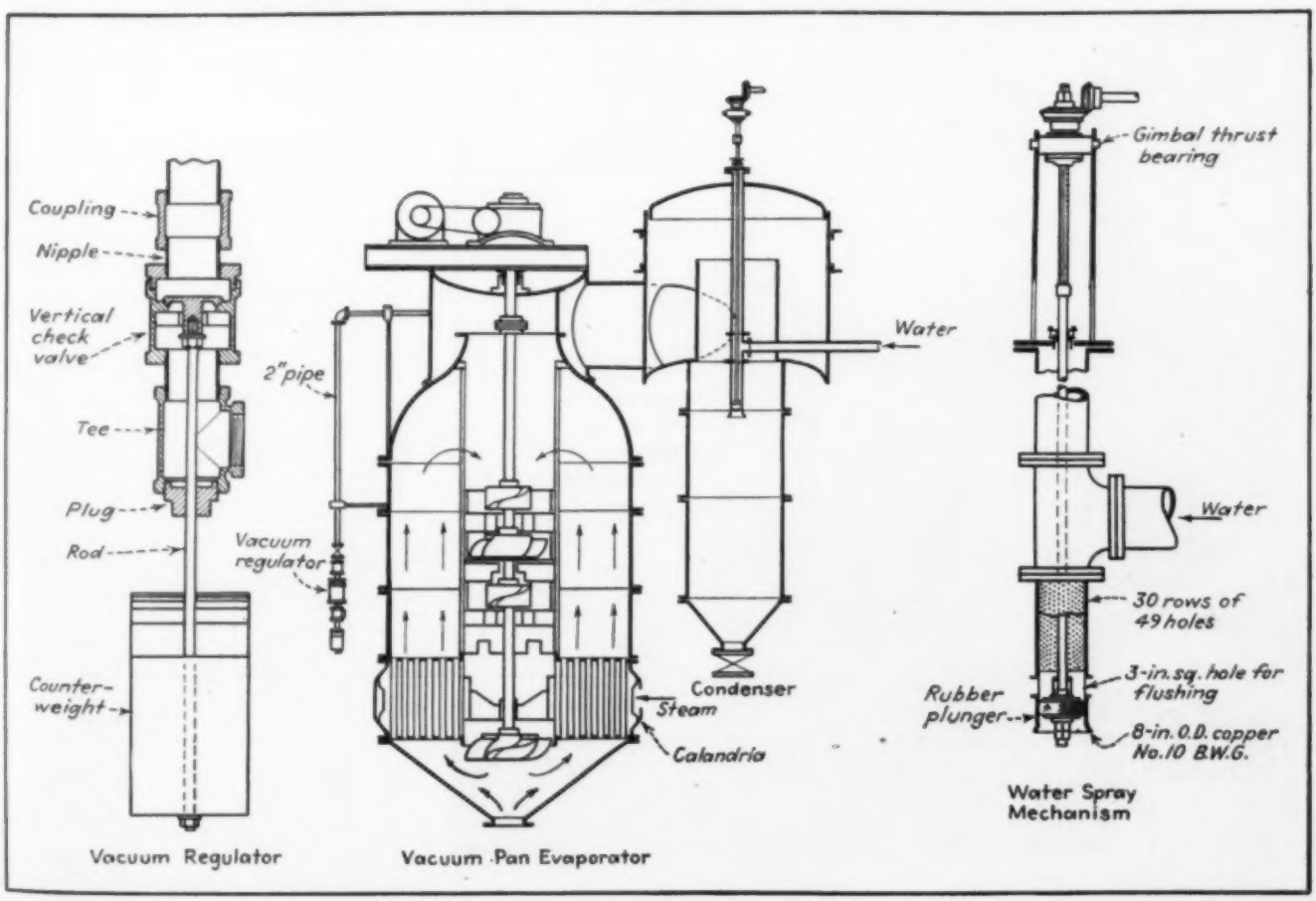
# FROM THE LOG OF EXPERIENCE

DAN GUTLEBEN, Engineer

**UNIFORMITY** of the degree of vacuum in a vacuum pan is essential to the acquisition of uniformity in size of sugar crystals. A drop in the temperature of the massecuite increases the supersaturation of the mother liquor and immediately causes precipitation of fine crystals because the sugar does not have time to accrete to existing crystals. Fluctuations in the vacuum thus effect irregular sizes of crystals which are difficult to purge and to wash in the centrifugals, and some fine crystals even pass through the screens with the sirup. The guilty finger for fluctuating vacuum of course points to the condenser.

**THE CONDENSER** ordinarily receives its water supply through weirs, sprays or perforated pipes. The finer the dispersion of spray into the vapor space, the greater is the surface of contact area between the cold water and the vapor and accordingly the greater is the heat transfer per gallon of water. Our old parallel flow condensers were equipped with horizontal 8-in. No. 14 copper pipes having $\frac{1}{8}$-in. perforations to equal the cross sectional area of the pipe. In the course of time the holes eroded and the original spray lost its vigor and assumed the shape of a coarse rope drapery. By insensible gradations the consumption of water increased as well as the difference in terminal temperatures. The sugar boiler, finding greater comfort in the practice of speculation on the swivel chair than in the physics of crawling through the small manhole near the ceiling when there was a Sunday supplement to be read at home, opined that the gradual decline of efficiency was due to the general moral decay. After the pipe had been in use five years, Frank Harvey, the "Super," chanced to compare the current chart of the two-pen terminal thermometer on the condenser with an old one and immediately made a holler! Then the cause was discovered, new No. 10 perforated pipes were installed for three 14-ft. pans and presto one 10-in. raw water pump with its 200 hp. motor was shut down. This brought the subject out into the open, and then in order to permit regulation of volume of the injection water without affecting the pressure, the spray pipe was arranged vertically and provided with a rubber plunger, as shown. By moving the plunger, as many spray holes can be uncovered as are needed to admit the quantity of water that the desired vacuum requires. The pressure of the water is constant and so the throttling of the volume does not affect the fineness or the vigor of the spray. This device has reduced the consumption of cold water and produces tail water of higher temperature. This has an additional advantage in that this water is used for boiler feed and for char washing and general plant supply. Moreover throttling can be made automatic by relaying an impulse from the vacuum within the pan for the control of a motor to set the plunger. The plunger stem could also be loaded with a counterweight analogously to the spring-loaded sprays in feed water heaters. In this

**Forced-circulation vacuum pan for evaporation of sugar solution; detail shows (left) vacuum regulator and (right) constant-pressure, variable-volume water spray mechanism**



case the water volume would be controlled by means of a chronometer valve and the pressure and volume would automatically set the position of the plunger. After the vertical spray was installed all of the cataract baffles were removed except the two at the bottom.

**NOW COMES AL WEBRE**, the internationally known pan expert of the U. S. Pipe & Foundry Co., with a simple vacuum regulator that removes the alibi of impecuniosity for any sugar boiler who wishes to take advantage of the profits of uniform vacuum but suffers from the restrictions of a cantankerous purchasing agent. In many of the Webre forced-circulation pans in Cuba he has installed a 2-in. vertical, weighted check valve vacuum breaker in front of the pan and connected it to the vapor pipe between the pan and the condenser. He sets the supply of injection water slightly above the demand for maximum vacuum and then lets a little air continuously bleed into the condenser to hold the vacuum at the point for which the counterweight is set. This simple device holds the vacuum within a fraction of an inch of the desired point.

**MECHANICAL CIRCULATION** in vacuum pans has long been thought of and some applications of the idea (including the chronicler's) had been made to prove its impracticability! However Al Webre ("Alfredo" to the Cuban sugar technologists) erected the achievement of success into an obsession. He applied the analysis of the blacksmith as well as the physicist and evolved a machine having the ruggedness of a rhinoceros. He followed his installations with painstaking tests and extracted amazing secrets which he promptly dissipated by way of bulletins (published by U. S. Pipe & Foundry Co.) to the craftsmen.

**WEBRE KNOWS PANS** in English, Spanish and French. When he discoursed on pans before the 1939 convention of "Los Technicos Azucarera" (for sugar) in Havana, they stood him up in front and decorated him with an honorary presidency for life. At home his son had difficulty with one of his college subjects and received a conditional grade. Down went Alfredo to the jewelers and bought the finest wrist watch he could find as a gift for the boy. The boy subsequently spent the war years flying over the Pacific. His brother (Yale '38) cruised in an Atlantic convoy and his sister's husband (Annapolis) commanded a fleet of subchasers. The enemy had a heavy price on their heads. Mrs. Webre and daughter Del took care of the wives and the babies.

His outstanding professional accomplishments include evaporator installations in many American and tropical sugar plantations and some very large distillery slop evaporators. When the borax plant was under development in Trona, Calif., years ago, Webre supplied the evaporator. The problem of foaming overwhelmed him. By way of groping, a foam index was established by stirring samples of liquid in a graduated glass, each test being standard as to quantity of liquid and period of stirring. The task was assigned to a laboratory boy. Each cycle of testing concluded with a soap washing and thorough rinsing of the glass. The

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routine grew monotonous. One noon when the staff returned from lunch they found the kid, in fear of censure, desperately trying to produce foam but the sample refused. "Hold everything." Speculation and investigation disclosed that the boy had forgotten to rinse the soap out of the test jar. Thus the kid's delinquency contributed to the success of Webre's evaporator.

**THE OLD VACUUM PANS** at the Pennsylvania Refinery, 14-ft. dia., were fitted with 1,300 sq.ft. of 4-in. coils in 75-ft. lengths and these were supplied with steam at 80 lb. from a turbine bleeder or from a pressure-reducing valve followed by desuperheater. To satisfy curiosity about the claim of the experts, we admitted steam at 100 deg. superheat into one of the coil pans and, sure enough, the liquor exhibited no ambition. It acted like a blanket of thick oil with an occasional bubble spluttering out of the surface. Q.E.D.

In 1934 all of the coils were replaced with calandrias having about 4,000 sq.ft. of heating surface and using steam at 35 lb. The desuperheater was bypassed and the thermometers in the steam supply lines to the pans indicated a superheat of 100 deg. but there was no complaint. The time cycle with the calandria pans was reduced by at least one third.

In anticipation of operator unhappiness a small turbine pump was installed under one of the pans to draw condensate out of the collector pot and spray it into the steam supply pipe. A starter button was installed at the pan control board but the current switch was left open. The plant continued its daily production of between three and four million pounds of sugar with nary a peep from the sugar boilers. Three years later a sudden commotion arose on the pan floor. The operator had just discovered the thermometer and observed the 100 deg. superheat. "How could he be expected to boil sugar with steam like that! It can't be done!" It was unfortunate that after three years of tranquility he had found the thermometer, but anyhow the solution was at hand. We threw in the current switch and told the operator to push the button in front of pan No. 4. Immediately he observed a drop of 100 deg. in the steam temperature but there was no change in the cycle time nor in the steam flowmeter reading. Eventually tranquility returned, the condensate spray was removed and the thermometers continued to indicate 100 deg. superheat.

For the benefit of the harassed maintenance crew, the ends of all copper tubes for pans and heaters are upset for a length of 1½ in. to two gages thicker than the rest. This allows an occasional rerolling without too much reduction in the wall thickness. The usual thickness of pan tubes is No. 12 BWG with ends upset to No. 10.

Parenthetically, when the pans were reconstructed, the junk men offered 5c. per lb. for the old copper coils. This price was not attractive and so the coils were converted into electrolytic pigs at 80 lbs. per 100 of coils; 42,000 lb. of these were stored in the basement against future requirements of bronze castings. The price of copper rose to nearly 20c. Eventually WPB commandeered the copper at 12c. and, barring a few pigs pilfered by some thirsty Trojan, the entire lot went to war.

# NAMES IN THE NEWS

H. T. Clarke

A. H. Calderwood

R. V. Yohe

**Hans Thacher Clarke,** member of the faculty of Columbia University, was chosen chairman-elect of the American Chemical Society's New York Section at the section's annual meeting.

**Eugene W. Roslofe,** formerly associated with the Institute of Fisheries Research in the Michigan Department of Conservation, has joined the staff of the Institute of Textile Technology, Charlotte.

**R. N. Griswold** has been promoted to be branch manager of the Pigment Department, Cincinnati office, of the Calco Chemical Division, American Cyanamid Co. He is a chemical engineering graduate of the University of Wisconsin.

**Hood Worthington,** on assignment for the last three years at the Hanford Engineer Works, has been appointed assistant director of the recently organized engineering research section, Rayon Technical Division, E. I. du Pont de Nemours and Co. A chemical engineer, he received his degree at Massachusetts Institute of Technology.

**T. P. Sands** has been appointed automotive engineer in the research department of Monsanto Chemical Co.'s organic chemicals division.

**Jan Teppema** has joined International Plastic Corp. of Morristown, N. J., as director of laboratory operations.

**Esther A. Engle** of the Commercial Solvents Corp., Terre Haute, Ind., has been elected chairman of the American Chemical Society's Wabash Valley Section for 1946-47. Miss Engle was chairman of the Lehigh Valley Section in 1940-41.

**Charles T. Thum** who served during World War II as Petroleum Containers Coordinator for the Army-Navy Petroleum Board, U. S. Joint Chiefs of Staff, has been named Chief Industrial Engineer of the Ansco division, General Aniline & Film Corp.

**A. H. Calderwood,** former manager of Shell Oil Co.'s Wilmington, Calif., refinery, has been made manager of the manufacturing department of Shell's San Francisco office to replace **Monroe E. Spaght,** recently appointed vice president of Shell Development Co. in New York. Calderwood, who has been with the company since 1923, was manager of Shell's wartime expansion at Dominguez, Calif.

**William N. Lacey,** professor of chemical engineering at the California Institute of technology, Pasadena, was recently presented with the Hanlon Award for meritorious services to the natural gasoline and condensate industries. The award is sponsored by the Natural Gasoline Association of America. Dr. Lacey is a member of the American Institute of Chemical Engineers and is chairman of the Southern California Chapter.

**Clark F. Barb** has been named head of the new department of petroleum production engineering at the Colorado School of Mines, Golden, Colo., and also director of petroleum research being conducted under the Colorado Industrial Development Research program. **James O. Ball,** formerly with the Bureau of Mines at Golden, is head of the new department of petroleum refining engineering. These two new departments are the result of reorganization of the department of petroleum engineering.

**George W. Merck,** president of Merck & Co. has been awarded the Medal of Merit the nation's highest civilian award, for his direction of the War Research Service. Mr. Merck has been on the chemical advisory committee of the Army and Navy Munitions Board since 1939 and was a special consultant to the Secretary of War on biological warfare from June 1944 to October 1945.

**Dale R. Eberhart** has been appointed Research Fellow of the Calco Chemical Division, American Cyanamid Co.

**Robert V. Yohe,** vice president, has succeeded **Burton F. Stauffer** as president and general manager of American Anode, Inc., affiliate of the B. F. Goodrich Co.

**Francis Chilson,** head of Francis Chilson Industrial Consultants, was awarded the honorary degree of Doctor of Science by Duquesne University at the annual commencement exercises.

**Robert B. MacMullin,** former assistant director of research, Mathieson Alkali Works, and more recently in Germany as a chemical investigator, is now a consulting chemical engineer in Niagara Falls.

**Clark G. Berry** has become chief chemist of the Delaware Rayon Co., New Castle, Del. He was previously in research work with the Cellulose Group at the Institute of Paper Chemistry, and the Research Department of Skenandoa Rayon Corp.

**George F. Kahle,** formerly associated with the Office of the Chief of Ordnance handling production safety in munitions manufacturing plants, has joined the Heyden Chemical Corp.

**Harry Burrell** and **C. P. Neidig** have formed Burrell & Neidig, an industrial chemical consulting firm with offices at 115 Broadway, New York City.

**Harry E. Cooper** has been appointed manager of the Lastex yarn and rubber thread division of the United States Rubber Co., succeeding **Harlow W. Waite,** who is retiring after 42 years with the company.

**Roger W. Hess,** chemical engineering graduate cf Brooklyn Polytechnic Institute, has been appointed to the sales engineering staff of Niagara Filter Corp.

**S. C. Massari,** recently awarded the Legion of Merit for his work in the Chicago Ordnance District, has been appointed technical consultant of the American Foundry-

men's Association. In the absence of **N. F. Hindle,** technical development program director, he carried through the program for the association's golden jubilee congress in Cleveland May 6 to 10.

**Maurice H. Lockwood,** outstanding figure in the fertilizer industry, and now chairman of the board of the National Fertilizer Association, will assume executive direction of the Association's activities as its president, at Washington, on July 1. He was a member of the Fertilizer Industry Advisory Committee during the war.

**J. Robert Oppenheimer,** professor of physics in the University of California, Berkeley, has returned to his post after a 4-year leave of absence, during which he served as director of the University's Los Alamos Scientific Laboratory, the New Mexico site of atomic bomb production. Professor Oppenheimer, who is one of the world's leading theoretical nuclear physicists hopes, as in the past, to act in a consultive capacity to the California Institute of Technology.

**Robert P. Parker** has been appointed assistant to the research director of the Calco Chemical Division, American Cyanamid Co. Dr. Parker received his doctorate from Yale University. For the past two years he has been an assistant director of the organic section of the research department.

**Ernest H. Volwiler,** executive vice president of Abbott Laboratories, received the honorary degree of Doctor of Science at the Miami University (Ohio) commencement exercises.

**Norman L. Krey,** formerly with the Aluminum Co. of America, has been made works manager of Permanente Metals Corp.'s aluminum reduction plant at Mead, Wash. **John R. Meek,** who will be works manager for the Trentwood, Wash., rolling mill of Permanente, was also formerly with the Aluminum Co. of America.

**George L. Neely** has returned to his former position as lubricant division manager for Standard Oil of California, San Francisco. Neely had previously done technical work for Standard, notably in fuel and lubricant research. He played a leading role in the development of Standard's diesel engine lubricating oil and was identified with the development of aviation gasoline. As a Commander in the Navy he served as a "trouble shooter" on engineering problems in the Pacific.

**Lee A. DuBridge,** chairman of the physics department at Rochester University, has been elected president of the California Institute of Technology, Pasadena, succeeding Dr. Robert A. Millikan, retired. Dr. DuBridge was for six years head of the radiation laboratory, Massachusetts Institute of Technology, and during the war directed the radiation laboratory established by the National Defense Research Committee at that institution.

**Francis M. Rich** has been appointed vice president in charge of operations at the Fontana, Calif., iron and steel plant of Kaiser Co., Inc. A graduate of the University of


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Illinois, Mr. Rich has a background of more than 20 years' experience in the iron and steel industry in the United States and Canada.

**Hal W. McClary**, previously general superintendent for Washington Veneer Co., Olympia, Wash., has been named general manager of the company to succeed E. E. Westman, president and founder of the firm who recently retired. Mr. McClary has been in the plywood industry since his graduation from the University of Washington.

**Harold A. Robinson** who has been doing research work for the last 15 years in the physical research laboratory of the Dow Chemical Co. at Midland, Mich., has been appointed to supervise research at a new laboratory opened by the company to expand its metals and cathodic protection research program.

**T. P. Sands** has joined Monsanto Chemical Co. at St. Louis, where he is engaged as automotive engineer in the research department of the organic chemicals division.

**Maurice L. Tainter**, director of the Sterling-Winthrop Research Institute has been elected a vice president of the Sterling Drug Co.

**William F. Talbot** has been appointed technical director of the Sun Oil Corp. and president of the fine chemicals division of the company. He formerly served as secretary of the corporation.

**Paul Logue** of Monsanto Chemical Co., St. Louis, was elected president of the American Association of Cereal Chemists at the annual meeting recently held in Niagara Falls.

**William S. Major** has been appointed development engineer for Bituminous Coal Research, Inc., Pittsburgh, where he will be responsible for promoting various research projects that have progressed far enough to justify commercial trial and use.

**Harry Price**, formerly a lieutenant colonel in the U. S. Army Air Forces, has resumed the practice of patent and trademark law in association with Dean, Fairbank & Hirsch in New York.

**Harold G. Osborn**, manager of the manufacturing department of Continental Oil Co., New York, has been elected vice president in charge of manufacturing.

**D. A. Rhoades** has recently been elevated to the position of vice president and general manager of Permanente Metals Corp.'s Aluminum Division, a new Kaiser operation at Mead and Trentwood, Wash.

**Everett C. Gosnell**, formerly manager, chemical division, Lukens Steel Co., has joined the Colonial Iron Works Co. as manager, chemical and process equipment division.

**R. E. Elliott** and **C. W. Burdette** have joined the chemical products department of Standard Oil Co. (Indiana). Mr. Elliott, for the past ten years has been in develop-

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ment work with Ideal Roller and Manufacturing Co. He is a graduate in chemical engineering from Ohio State University. Mr. Burdette was formerly a lieutenant in the Navy, and prior to the war was employed by Monsanto Chemical Co.

**Brooks Darlington**, formerly sales promotion manager of the DuPont Co.'s Nylon Division and for the past three years an official of the Office of War Information has returned from his overseas assignments.

**Milton R. Beasley**, chemical engineer, formerly with Bird and Son, Inc., has entered private consulting work as a roofing specialist.

**Edgar S. Thompson**, who received his master's degree in chemical engineering at Harvard University, has been appointed to the rubber and plastics machinery sales organization of Farrel-Birmingham Co.

**C. P. Joslyn**, manager of the chemical products division, Goodyear Tire & Rubber Co., was recently presented with a 20-year service pin marking the completion of two decades with the company.

**Crawford H. Greenewalt**, assistant general manager of the DuPont Pigments Department, has been appointed to succeed Jasper E. Crane as vice president and member of the Executive Committee of E. I. du Pont de Nemours & Co. Mr. Crane has retired.

**Carroll L. Wilson**, formerly executive assistant to the director, Office of Scientific Research and Development, has been elected vice president of the National Research Corp.

**Roger Adams**, recently special advisor to the deputy military governor of the American occupation zone in Germany, has received the Theodore William Richards Medal of the American Chemical Society's Northeastern Section. While abroad, Professor Adams received the Davy Medal of the Royal Society of London.

**Harry G. Drickamer** has been appointed assistant professor of chemical engineering and **Joel O. Hougen** instructor in chemical engineering at the University of Illinois. Dr. Drickamer was formerly with the engineering and development department of Pan American Refining Corp. Mr. Hougen was formerly with the Union Oil Co. of Calif.

**Joel O. Hougen** instructor in chemical engineering at the University of Illinois. Dr. Drickamer was formerly with the engineering and development department of Pan American Refining Corp. Mr. Hougen was formerly with the Union Oil Co. of Calif.

**William C. McIndoe**, chemical engineer, recently returned from active duty in the army to resume his duties with the Bonneville Power Administration, Portland, Oregon.

**E. T. Lessig** has been named general manager of textile control of the Tire Division of B. F. Goodrich Co. Dr. Lessig received his bachelor's degree in chemical engineering from Penn State University and his doctor's degree from the University of Wisconsin.

**W. D. Parrish**, technical service manager for synthetic rubber, for the B. F. Goodrich Chemical Co., Cleveland, has assumed the

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You, too, can rely on their dependable performance to meet your requirements for "jeep" power. Like all Coppus "Blue Ribbon" products (blowers, ventilators, gas burners, etc.), the Coppus turbine is a precision-made product — its accuracy controlled by Johansson size blocks — and every turbine is dynamometer-tested before shipment. Since 1937, more than 85% of orders have been repeat orders. Write for Bulletin 135-10. COPPUS ENGINEERING CORPORATION, 456 Park Avenue, Worcester, Mass. Sales Offices in THOMAS' REGISTER. Other products in SWEET'S, CHEMICAL ENGINEERING CATALOG, REFINERY CATALOG.

additional duties of technical service manager for rubber chemicals.

**John J. Conroy, III,** discharged after serving 44 months in the U. S. Coast Guard, has resumed his position as president of National Magnesium Corp., New York.

**T. Ivan Taylor,** research chemist formerly with the University of Minnesota has been named associate professor of chemistry at Columbia University.

**W. H. Holstein,** who has been assistant manager of the Sabine River Works being built near Orange, Tex., by E. I. du Pont de Nemours & Co., has been named assistant manager of the Du Pont ammonia department. **Clark Barrett,** formerly general production superintendent of the Belle, W. Va., works is now assistant manager of the Texas plant.

**Howard F. MacMillin** has been elected vice president of Bryant Machinery & Engineering Co., Chicago.

## OBITUARIES

**Clement Leath Speiden,** 52, vice president of Innis Speiden & Co., and past president of the New York Junior Board of Trade died in the University of Virginia Hospital, Charlottesville, Va., on June 2.

**Maximilian Toch,** 81, president and chief chemist of Toch Brothers, Inc., chairman of the board of Standard Varnish Works and nationally-known lecturer and writer on chemistry and chemical engineering, died in New York May 28.

**Elford D. Streeter,** formerly chief chemist of the Staten Island, N. Y., plant of the Gulf Oil Refining Co., which he served for 25 years, died at his home in Westfield, N. J. May 28.

**Howard W. Starkweather,** 55, a member of the executive staff of the Jackson Laboratory of the DuPont organic chemicals department, died unexpectedly of a heart attack on Saturday, May 18. He has been at Jackson Laboratory since 1934.

**Arthur E. Frankel,** 28, chemical engineer and member of a prominent Cleveland family, died May 17 at Michael Reese Hospital, Chicago.

**Henry V. Dunham,** 70, chemist, formerly vice president of the Casein Co. of America and director of American Plastics Corp. passed away on May 11, at Bainbridge, N. Y.

**Joseph J. Mangin,** former president of the United Color & Pigment Co. of Newark, N. J., and who retired from that firm in 1937, died at his home in that city on May 11. Mr. Mangin was one of the founders of the United company in 1917.

**Vere B. Edwards,** 56, president of the Dravo Corp., passed away Wednesday, May 8, while attending a meeting of the Executive Committee in the Board Room at the Neville Island plant.

Selection of factory-assembled Limitamp control for this plant made it possible to install a single compact group, instead of a number of separate devices, in a small amount of floor space.

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# INDUSTRIAL NOTES

**Van Norman Co.**, Springfield, Mass., has purchased substantially all the outstanding stock of the Morse Twist Drill & Machine Co., New Bedford, Mass. The company will be operated as a separate corporation, and will remain in New Bedford. The new officers are James Y. Scott, president; James A. Wright, vice president and general manager; E. C. Adams, vice president and assistant general manager; M. J. Rainey, general sales manager, and L. H. Stanton, treasurer.

**Ohio Rubber Co.**, Willoughby, has appointed R. Dean Thomas to be plant manager of the new plant the company is about to open at Long Beach, Calif. At the same time A. Schade was made chief chemist and Louis Kotich was made general engineer. L. E. Budnick is now assistant treasurer and assistant secretary of the California plant.

**Filter Paper Co.**, Chicago, moved into their new and larger quarters at 2426 S. Michigan Ave., on June 1.

**Hammond Iron Works**, Warren, Pa., has appointed B. W. Rogers, P. O. Box 1030, Akron to represent the company in the Akron district.

**B. F. Goodrich Co.**, Akron, recently created an electronic applications development department. William L. Jenkins has been named to the post of manager.

**Hercules Powder Co.**, Wilmington, recently announced the return of Frank H. Crymes who was recently discharged from Army service. Mr. Crymes will serve as district manager of the synthetic department in San Francisco.

**Rust Engineering Co.**, Pittsburgh, has been awarded a contract for construction of buildings and facilities which will increase the plants of American Viscose Corp. at Meadville, Pa. by 50 percent.

**Ajax Flexible Coupling Co., Inc.**, Westfield, N. Y., has purchased an 11 acre site and, pending permission from the CPA, plans to erect a new factory to increase production of conveyors and screens.

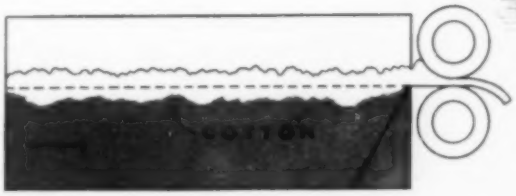
**Container Testing Laboratories, Inc.**, New York, has elected E. A. Throckmorton to the position of president.

**Pemco Corp.**, Baltimore, Md., has completed its fifth continuous smelter unit. The new unit along with improvements in the four continuous units now in operation is expected to increase the capacity of the plant more than 50 percent.

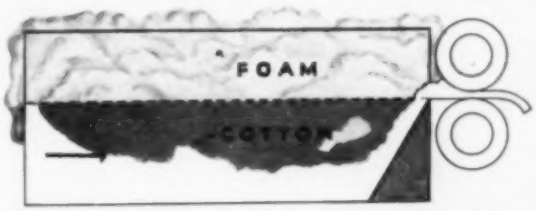
**B. F. Goodrich Chemical Co.**, Cleveland, has made Ray E. Bitter sales representative on the Pacific Coast with headquarters at 1248 Wholesale St., Los Angeles. Howard E. Anderson is now the midwestern territory

# FIREPROOFING RAW COTTON

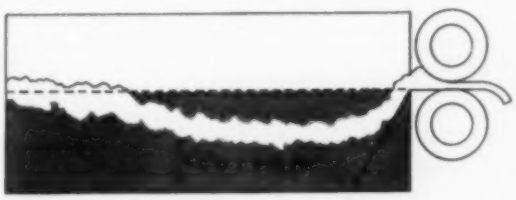
## A problem of controlled penetration in a continuous process . . .




Without an efficient wetting agent cotton floats on surface all the way to the squeeze rolls. Uniform and effective penetration of fireproofing salts is impossible.




Uncontrolled penetration . . . usually accompanied by wasteful foaming . . . may cause cotton to sink to bottom of tank thereby impeding processing.



Controlled penetration with Victawet 35B produces practically no foaming. Cotton sinks just below surface . . . machine operates at maximum efficiency . . . rejects are eliminated.

## *Solved with*

## VICTAWET 35B

**Problem**—Because raw cotton is hard to wet, surface-active agents or penetrants which work effectively in the presence of fireproofing salts are required. During the war several plants experimented with various penetrants for this type of work. Some proved unsatisfactory because of excessive foam which wasted solution and made working conditions difficult. Others failed to control speed of penetration resulting in imperfectly fireproofed cotton and subsequent rejections.

**Solution**—Use of Victawet 35B was recommended by Victor's Research Laboratory. In practical tests, proper concentrations of this new Victor surface active agent provided efficient wetting with practically no foaming. Penetration was controlled so that the cotton sank just below the solution surface without collecting at the bottom of the tank. Speed of processing was stepped up as much as 25%. Production was perfect, and uniform results were demonstrated by flame tests on the finished goods.

Many other penetration problems have been solved with Victor surface-active agents. If you have a problem, think first of a phosphate from Victor.

GOT A PROBLEM
THINK FIRST OF A phosphate
from VICTOR

VICTOR CHEMICAL WORKS

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technical service engineer. His headquarters are in the company's Chicago offices.

**American Mineral Spirits Co.**, Chicago, has returned Karl F. Giloth to the Columbus, Ohio sales office. He will cover Ohio, Indiana, Michigan, Kentucky, West Virginia and western Pennsylvania. Mr. Giloth recently completed two years of duty with the Navy.

**Iron & Steel Products, Inc.**, Chicago, has made Charles A. Marshall general manager.

**National Radiator Co.**, Johnstown, Pa., has appointed David M. Ramsay to be manager of the industrial division.

**Hammel-Dahl Co.**, Providence, has named Wayne B. Farley to the position of district manager of the Pittsburgh Office.

**Vilter Mfg. Co.**, Milwaukee, Wis., has promoted Albert O. Vogel to the position of general sales manager. Erich J. Kocher has been promoted to chief engineer. Donald F. Ahlswede has been appointed production control manager.

**Brooks Equipment Corp.**, Hoboken, N. J., has consolidated the executive and sales offices and production facilities at the new headquarters in Hoboken.

**Permutit Co.**, New York, has appointed H. L. Bechner and A. D. Way, technical manager and chief mechanical engineer, respectively. Mr. Bechner will be responsible for the company's technical policy. He will also serve as chairman of the engineering committee. Mr. Way will administer the engineering department and supervise the mechanical design and layout of equipment.

**H. K. Porter Co., Inc.**, Pittsburgh, has opened a new district office in the Paul Brown Building in St. Louis. R. E. Nelson is the St. Louis district sales manager.

**St. Joseph Lead Co.**, New York, has made Charles R. Ince manager of metal sales. Malcolm Bonynge has returned to the company as assistant manager. Dwight Marshall was also named assistant manager.

**Detrex Corp.**, Detroit, has named L. C. Kroes manager of the central regional sales. His headquarters will be in Detroit.

**American Cyanamid Co.**, New York, has appointed Arthur A. Rauchfuss to the position of assistant sales manager of the Calco Chemical Division. He will be in charge of sales of dyestuffs and intermediates to the dry color manufacturers.

**Acme Rubber Mfg. Co.**, Trenton, N. J., has appointed L. J. Amsdell to the post of western territory sales manager. His headquarters will be in the Chicago office.

**Upjohn Co.**, Kalamazoo, Mich., has made the following changes in its sales organization: W. G. Freeman has become assistant general sales manager with supervision over the three southern branches at Atlanta, Memphis, and Dallas. His headquarters are in Atlanta. J. J. Canon also became assist-

ant general sales manager. He will supervise the Kalamazoo and San Francisco branches with headquarters at Kalamazoo. W. G. Sugg has been named sales manager of the Atlanta branch. J. W. Schma is now sales manager at Kalamazoo.

**Hercules Powder Co.**, Wilmington, has made James T. Skelly, Jr. assistant director of sales of the Cellulose Products Department. He recently returned to the company after receiving his discharge from the army.

**Allen-Bradley Co.**, Milwaukee, is now represented in the Seattle area by Muth-Richards Co., 1426 Broadway, Seattle.

**Bituminous Coal Research, Inc.**, Pittsburgh, has moved to 912 Oliver Building, Pittsburgh.

**Byron Jackson Co.**, Los Angeles, Calif., has merged with Patterson-Ballagh Corp., in which it has held a minority interest since its formation. The manufacture and sale of Patterson-Ballagh products will continue under that name with the company being operated as a separate division of Byron Jackson. No immediate changes in management, personnel or sales distribution are planned.

**Turco Products, Inc.**, Los Angeles, Calif. has recently appointed Robert K. Yeck as technical service representative for the State of New Mexico. Recently discharged from the Army Air Forces, Mr. Yeck will have offices in Albuquerque at 200 Korber Building.

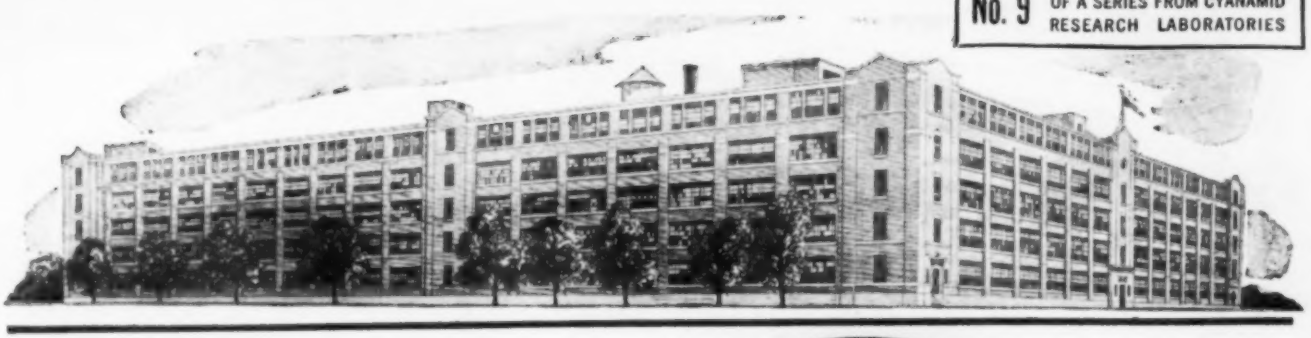
**Eitel-McCullough, Inc.**, San Bruno, Calif. has increased its sales engineering staff by the appointment of Winfield Wagener, formerly associated with Heintz & Kaufman and the Litton Engineering Laboratories.

**Standard Oil Co. of California**, San Francisco, recently announced the appointment of W. C. Lane as assistant manager of the company's foreign trade department. Former president of California Commercial Co., a subsidiary, Mr. Lane has been associated with Standard of California since 1926.

**Denver Equipment Co.**, Denver, Colo., has advanced T. S. Bailey, Jr., former sales manager, to the newly created office of vice president. Mr. Bailey will be concerned with the company's United States expansion as well as its foreign manufacturing subsidiaries. A graduate of the University of Colorado, Mr. Bailey has been associated with the company since 1933.

**United States Rubber Co.**, San Francisco, Calif., has appointed Walter C. Burns district sales manager of the mechanical goods division, with supervision over northern California and most of Nevada. A graduate of the University of California, Mr. Burns returned recently to the company after four years of service in the armed forces.

**American Gilsonite Co.**, Salt Lake City, Utah, has established headquarters in the Utah Oil Building. The company was formed by a recent consolidation of the Utah operations of Barber Asphalt Corp.,



# Now...1 Molecule

## Combining Alcohol and Nitrile


This new compound combines the chemical and physical properties of alcohol and nitrile, producing an intermediate that can be used for the production of many other organic chemicals. Among those you can prepare, the following are typical; however, samples are not available at the present time.

β—hydroxy propionic acid, its salts and esters

$HO\text{-}CH_2\text{-}CH_2\text{-}COOH$
$HO\text{-}CH_2\text{-}CH_2\text{-}COOMe$
$HO\text{-}CH_2\text{-}CH_2\text{-}COOR$

β—chloropropionitrile and derivatives

$Cl\text{-}CH_2\text{-}CH_2\text{-}CN$
$Cl\text{-}CH_2\text{-}CH_2\text{-}CONH_2$
$Cl\text{-}CH_2\text{-}CH_2\text{-}COOH$

Propanol amines

$HO\text{-}CH_2\text{-}CH_2\text{-}CH_2\text{-}NH_2$

### Possibilities as a solvent

The presence of hydroxyl and cyano groups makes this compound potentially valuable as a solvent. It is soluble in water, acetone, ethanol, chloroform and diethyl ether, and can be used as a solvent for many inorganic salts. This may be valuable in solvent extraction operation.

### Properties

Aero Ethylene Cyanohydrin is a straw colored liquid, 96-98% pure, and weighs 8.7 pounds per gallon. The boiling point is 227-8°C. (with decomposition). Under reduced pressure it can be readily refluxed or distilled without decomposition at neutral pH's. It is available for immediate delivery in commercial quantities.

If you have a problem in the field of organic nitrogen chemicals, call or write us. Address Section ND, Synthetic Organic Chemicals Department, American Cyanamid & Chemical Corporation, 30 Rockefeller Plaza, New York 20, N. Y.

*Other Organic Nitrogen Chemicals*

| | |
|---|---|
| Acrylonitrile | $CH_2=CH\text{-}CN$ |
| Guanidine compounds | $H_2N\text{-}C(=NH)\text{-}NH_2$ |
| Guanylurea sulfate | $(H_2N\text{-}C(:NH)\text{-}NH\text{-}C(:O)\text{-}NH_2)_2H_2SO_4$ |
| Glycolonitrile | $HO\text{-}CH_2\text{-}CN$ |
| Lactonitrile | $CH_3\text{-}CHOH\text{-}CN$ |
| Dicyanidiamide | $H_2N\text{-}C(:NH)NHCN$ |

*Reg. U. S. Pat. Off.

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*Gentlemen:*

☐ *Rush my sample of Aero Ethylene Cyanohydrin*

☐ *Rush copy of technical data sheet*

*Name*_____

*Position*_____

*Company*_____

*Address*_____

**HEADQUARTERS FOR NITROGEN CHEMICALS**

and a division of Standard Oil of California. C. F. Hansen, president and C. F. Morris, secretary-treasurer, will maintain headquarters in Salt Lake.

**Speedways Conveyors, Inc.**, Buffalo, N. Y., has appointed Jess Keville to be exclusive representative in Southern California and adjacent territory. His office will be in Pomona.

**Bird Machine Co.**, South Walpole, Mass., has elected F. K. Becker to the presidency of the company.

**Fluor Corp. Ltd.**, New York, has appointed Kenneth D. Demarest to be district engineer at New York headquarters.

**Godfrey L. Cabot, Inc.**, Boston, has made Donald Simonds assistant sales manager.

**Mercury Glass Co.**, Pleasantville, N. J., has named Garfield C. Burrows and John C. Shipley to managerial posts.

**Norton Co.**, Worcester, Mass., has appointed Fred H. Paulson and Curtis H. Weissinger to the post of sales engineers in the refractories division. They will make their headquarters in the Worcester office.

**Delta-Star Electric Co.**, Chicago, has appointed the Florida Electric Supply Co., Tampa, to be representatives in the state of Flordia except the northeast portion west of the Apalachicola River.

**Empire Chemical Corp.**, New York, has moved to new and larger quarters at 21 West St.

**Witco Chemical Co.**, New York, has consolidated the Marshall Dill organization, San Francisco, with the Pacific Coast activities of Witco. Mr. Dill has been elected a vice president of the company in charge of the California division.

**Foote Bros. Gear & Machine Corp.**, Chicago, has appointed Irving C. Maust to their West Coast sales engineering staff. He will be located in Pasadena.

**Liquid Conditioning Corp.**, New York, has been organized by S. B. Applebaum, H. L. Tiger and Norman E. Brice, who were formerly connected with the Permutit Co. in executive positions. The present offices are at 423 West 126th St. Plans have been laid for the construction of a plant at Linden, N. J.

**International Nickel Co.**, New York, has placed R. M. Wilson, Jr. in the technical service section of the development and research division of the company. Mr. Wilson is chairman of the New Jersey Section of the American Welding Society.

**Virginia-Carolinia Chemical Corp.**, Richmond, Va., has returned the following men to their former positions with the company following their return from the armed forces. Colonel Edwin Cox, Lt. Commander William T. Thomax, Lt. Homer Moomaw, Capt. Wortham Spilman Jr., and Fred Tucker. The following men have returned to their work in the technical service and

development branch: Capt. Raymond J. Lakey and Lt. Edward F. Smith. Major John Y. Mason is now with the production branch. All who served during the war have returned to their positions for peacetime production.

**Carbide and Carbon Chemicals Corp.,** New York, has moved its Buffalo district office to the Liberty Bank Building at 424 Main Street. R. C. Boltz is in charge of the district.

**Pittsburgh Plate Glass Co.,** Pittsburgh, has appointed Robert Wardrop as assistant manager of glass advertising and promotion. He recently completed his terminal leave as a Lieutenant Colonel after four years with the Army.

**Monsanto Chemical Co.,** St. Louis, Mo. has promoted Robert E. Holmes to fill the position of divisional export manager for the Merrimac division at Everett, Mass. Roy T. Cowing will handle Merrimac sales in the Philadelphia area, Ralph E. Nelson has been moved to the Chicago Office. Edwin L. Hobson has been appointed to the sales staff of the Plastic Division.

**Eli Lilly & Co.,** Indianapolis, has just announced the purchase of government owned facilities and the Stokely Foods buildings at West Morris Street and Kentucky Avenue. The buildings will be known as the Kentucky Avenue plant and will give an additional million square feet of floor space.

**John A. Roebling's Sons Co.,** Trenton, has appointed Ferdinand W. Roebling, 3rd, to the position of vice president in charge of engineering.

**General Electric Co.,** Chemical department, Pittsfield, Mass., has appointed Harold L. Aldrich district representative in the New York Office. He will handle glyptal alkyd resins.

**American Heater Co.,** Philadelphia, has promoted Colonel R. W. McClenahan. He was elected vice president recently. During the past war he served with the Army Air Forces. He has been decorated with the Legion of Merit, Bronze Star and the Order of British Empire.

**Consolidated Products Co.,** New York, has purchased the Thermoid Rubber Plant at S. Clarence Street, Los Angeles. It comprises about three acres of ground, with 100,000 sq. ft. of manufacturing space. Negotiations are under way to reopen the plant under new ownership, but should these plans fail undoubtedly the machinery will be liquidated and distributed to other rubber plants.

**Fairbanks, Morse & Co.,** Chicago has recently appointed C. L. Richard special representative of its sales division with headquarters at Chicago. For the past three years he served in the Ordnance Bureau of the U. S. War Department.

**Davidson & Serner,** New York, is a new firm organized for the sale of special equipment in process engineering. W. H. Davidson and H. E. Serner have organized the

company, which will have offices at Commercial Trust Building, Philadelphia, and 342 Madison Ave., New York.

**Sam Tour & Co., Inc.,** New York, has added a department of mechanical engineering to the chemical engineering, metalfinishing, metallurgical engineering and physical metallurgy facilities. E. V. Crane is head of the new department.

**Hagan Corp.,** Pittsburgh, Pa., has transferred Gerald G. Lipke to Denver, Colo., as district field engineer. Mr. Lipke recently returned from the army.

**Hewitt-Robins, Inc.,** Buffalo, N. Y., is the new name of the Hewitt Rubber Corp. The name was changed to bring in the identity of its wholly owned subsidiary, Robins Conveyors Inc. The Passaic, N. J. plant will now be known as the Robins Conveyors division.

**National Starch Products, Inc.,** New York, has promoted Donald D. Pascal to the position of assistant vice president.

**Reliance Electric & Engineering Co.,** Cleveland, will break ground shortly for a new plant in Ashtabula, Ohio. The 25-acre site is located on the west side of the town between the New York Central R. R. and route 20.

**Mathieson Alkali Works,** New York, has opened a new dry ice service center and started construction of a new warehouse in Long Island City.

**Conversions and Surveys, Inc.,** New York, has been organized recently. Principal offices of the new company are located at 90 Broad Street. John H. Warden is president.

**Kieley & Mueller, Inc.,** North Bergen, N. J., has appointed the Ryder Equipment Co. of St. Louis to be representatives in Missouri and southern Illinois.

**Mimex Co.,** Brooklyn, N. Y. has moved its offices, laboratory and plant to 37th St. and 12th Ave.

**Dampney Co. of America,** Hyde Park, Mass., has assigned Kenneth E. Greene to its Chicago office and William T. Campbell to the Philadelphia office. Both men will be working with the sales engineering force.

**Detrex Corp.,** Detroit, has promoted S. H. Bivins to the position of manager of western regional industrial sales. Headquarters will be in Chicago.

**Yale & Towne Mfg. Co.,** New York, has elected Robert Ten Broek Stevens to its board of directors.

**Vapor Recovery Systems Co.,** Compton, Calif., has appointed E. S. Powell, sales manager for the Great Lakes territory. His offices are located at 122 S. Michigan Ave., Chicago.

**Iron & Steel Products, Inc.,** Chicago, has made George L. Bladholm special representative with headquarters in the Chicago offices.

# CONVENTION PAPER ABSTRACTS

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### CORROSION STUDIES ON ELECTROLYTIC CHROMIUM

ELECTROLYTIC chromium stripped from its basis metal, was immersed in aqueous solutions of NaOH, HCl, $H_2SO_4$, $HC_2H_3O_2$, and NaCl at various concentrations with the last being studied over a pH range from 0 to 11. The metal was used in both the active and passive state and the solutions, saturated either with air, nitrogen, or hydrogen, were maintained at 35 deg. C. The passive metal showed only isolated instances of attack, while in the active state reaction occurred in all of the media in which the pH could be maintained below 3. With higher pH values the metal generally became passive again after a short time, even in the deaerated solutions. Weight change values were obtained for the active chromium and it was shown by microscopic examination that the type of attack could be related to the medium the concentration, and the relative period o immersion. Short exposures in acid media showed that attack first appeared along the crack network system of the chromium plate and that typical acid etch patterns were observed for sufficiently long exposures. In alkaline NaCl solutions, isolated points of attack were found which were not related to the crack system. NaOH solutions produced no noticeable change.


Norman Hackerman and D. I. Marshall, University of Texas, before The Electrochemical Society, Birmingham, Ala., April 1946.


### RESEARCH EXTENDS OUR PETROLEUM RESERVES

OPPORTUNITIES through research in the utilization of petroleum and natural gas have been demonstrated time and time again beyond question. The same opportunities exist in the other fields of activity related to the petroleum and natural gas industries. New procedures and techniques are being developed which will greatly improve our exploration methods. As we gain a better and better knowledge of the earth's

structure as it affects petroleum products we will increase our reserves.

The layman looking at the petroleum and natural gas industry at the beginning of the war would have had ample reason to feel that the acme of perfection in techniques had been reached. However, when considering the great advances made in the industry in the war years only, opportunities for the further future advancement in the art of refining and utilization can be realized. The potentialities of catalysts alone in the industry represent an entire new era in technology. They will not only give us better fuels but will expand and extend the products and values of hydrocarbons.

Research and development opportunities do not stop here. They go on into improved methods of transportation and distribution as well as the engineering of the processing plants. Greater efficiency will be expected through new techniques, new processes, and new materials tailored to more perfectly meet the trying and special conditions of these processing plants.

It is well, then, that we are concerned with extending the life of usefulness of these extremely important natural resources —petroleum and natural gas—for the supply is limited and we cannot add to it. The day is undoubtedly coming when we will have expended our petroleum and natural gas resources and can then turn only to our coal deposits to meet hydrocarbon needs—a matter for the contemplation and study of our children and their children. We owe it to ourselves and those who will follow us to do the very best with what we have and make the supply go as far as possible. Technology and free enterprise alone will meet these problems.

Harold Vagtborg, Midwest Research Institute, before Interstate Oil Compact Commission, Tulsa, Okla., April 13, 1946.

## NEW PROCESS FOR ETHYLBENZENE

A LIQUID phase process developed by Socony Vacuum for ethylbenzene production uses ethylene and aluminum chloride as in many of the older processes to convert benzene to ethylbenzene; but by operating at a slightly higher temperature, 212 deg. F. instead of 150 to 190 deg. F. and applying pressure to the ethylene, the yield of ethylbenzene is increased considerably.

For example, using eight parts of benzene to one of ethylene, which usually gives about 48 to 64 percent yield, the new process has given at least 80 percent yield in one step. In this case only 28 percent of the benzene was converted. A higher percentage, 46 percent, can be processed to ethylbenzene in one step, but this time only 66 percent of the ethylene goes to form the desired product.

Another advantage of the new process is a much faster reaction. The experiment giving an 80 percent yield took only 3 min. compared with at least 2 hr. for the previous liquid phase operations. This faster rate makes the process more adaptable for continuous operation. It also makes possible the use of dilute ethylene, down to about 10 percent. This is a large saving in cost, since it is expensive to concentrate the low percentage of ethylene found in refinery gas up to the nearly pure form usually used for making ethylbenzene. The benzene can even

be used in 25 percent concentration in gasoline, and still get pure ethylbenzene by simple distillation of the product.

The vapor phase process employs the same catalysts which are used in commercial cracking. These catalysts are durable and not easily poisoned. The reaction which takes place at high temperature deposits small amounts of carbon on the catalyst. Occasionally this must be burned off with air, making the catalyst as good as new.

With a temperature of 925 deg. F. and 50 lb. pressure and a five-fold excess of benzene, 80 percent of the ethylene is converted to monoethylbenzene in one step, the rest going to polyethylbenzene. By increasing the excess of benzene to ten fold the yield of ethylbenzene is increased to 85 percent. All products of the reaction are easily separated by distillation. The unreacted benzene is then available to be used again. The process is readily adaptable to continuous cyclic operations.

A. W. Francis, E. E. Reid, A. A. O'Kelly, John Kellett and J. B. Plucker, Socony-Vacuum Oil Co., before the Petroleum Division, American Chemical Society, Atlantic City, April 10, 1946.

## ECONOMICS OF CHLORINE CELL OPERATION

For the present study 18 cylindrical cells were installed and operated for the duration of their anode lives. Cell house operating conditions were, of course, maintained as constant as possible during this period. One group of 6 cells was run with the normal three diaphragms. That is, the cells were installed with new anodes and diaphragms and were run for one-third of the anticipated life of their anodes (120 days). Their diaphragms were then renewed. A renewal was again made after another 120 days. Then the cells were run till failure of the anodes.

A second group of 6 cells was run with two diaphragms. In their case only one renewal was made, and this at an assumed half-life of the anodes (about 160 days). The cells were then run until the anodes failed. The third group of six cells was run with only one diaphragm. That is, it was installed and simply run until the anodes wore out.

The cells were all tested a few days after being installed and then about every three weeks thereafter during their anode life period. Tests consisted of measuring voltage drop and ampere load on the cell while collecting a sample of its cell liquor. A liter graduate was used for this collection, and the flow time (about 3 min.) accurately measured. The volume and specific gravity of the sample were then noted. The rate of flow was determined twice on each test, and if there was more than 1 percent difference in the two determinations, another flow rate was taken. If there was still considerable discrepancy, the cell was assumed to be out of equilibrium and allowed to run for a day or two and was then tested again. A sample of feed brine was also taken during the tests.

The above data were sufficient to enable determination of voltage and ampere efficiencies. Also from these data we could check the ampere efficiency *vs.* cell liquor caustic strength, salt *vs.* cell liquor caustic strength, and cell liquor caustic strength *vs.*

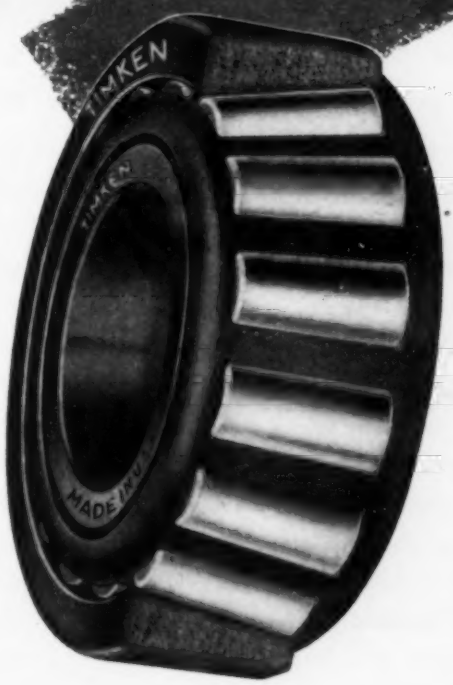
# Timken Bearings

## meet all chemical plant requirements

The elimination of friction and wear; the ability to carry radial, thrust and combined loads; and the holding of moving parts in constant alignment; are just as important in chemical plant equipment as they are in industrial machinery of every kind. Timken Tapered Roller Bearings provide all these necessary qualities.

Furthermore, the design of the Timken Bearing and the precision with which it is made enable such effective bearing closures to be applied that the bearings are amply protected against dust, dirt and injurious substances common to the process industries. Likewise the product is protected against danger of contamination through leakage of lubricant.

Be sure that the tapered roller bearings used in your equipment are genuine Timken Bearings; look for the trade-mark "TIMKEN" stamped on every cup and cone.

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*TAPERED ROLLER BEARINGS*

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diaphragm age relationship which had been obtained in our previous study. Results of the study were:

1. The existence of a straight line relationship showing the decline of ampere efficiencies with increasing cell liquor caustic strengths was reaffirmed.
2. There is a decided trend for increased anode life with higher ampere efficiences.
3. With the operating conditions and unit costs which were used, it would be cheapest to run the cells with only two diaphragms (one renewal) per anode life. However, there appears to be little difference in running with one, two or three diaphragms.
4. The total cell product costs obtained from each of the one-, two- and three-diaphragm groups were still declining at the termination of their anode lives.

L. P. Wenzell, P. J. Stuber and S. Cottrell, Monsanto Chemical Co., before The Electrochemical Society, Birmingham, Ala., April 1946.

## GEIGER-COUNTER X-RAY SPECTROMETER

Since the bulk of materials in nature are crystalline aggregates, it follows that a study of the crystal structure will divulge a great deal of information. X ray diffraction is employed for such studies and can give answers that are unequivocal.

So called soft x-rays as are presently employed in x-ray diffraction techniques are very high frequency electromagnetic waves of essentially monochromatic frequency. Because of the regularity of structure in a crystal it can be regarded as being a three dimensional diffraction grating that will diffract these rays much the same as light is diffracted by an optical grating.

This, of course, will enable the dimensions between parallel planes of atoms to be determined by studying the relationship between wavelength and diffraction angle.

If the crystal is rotated it follows that all planes will be irradiated and reflections given off by all such planes. These reflections are known as intensity maxima, and if a piece of sensitized photographic film is situated radially about the crystal, they will blacken the film at the angle of reflection. From this can be determined the angle of reflection from every plane in the crystal and consequently the "d" value. In nature, however, crystals occur as agglomerates, but this does not make any difference to the method.

Each individual substance present in a mixture will give off reflections upon being irradiated as though it alone were present. This fact makes possible the qualitative and quantitative analysis of complex materials in a simple fashion because the information obtained is a series of "d" values with different intensities. These data are listed, and by comparison with tables, composition of the unknown materials can be determined. Relative intensities of the maxima from each material determines the amount of each present.

This is known as the powder method of identification. The sample is in the form of a powder coated on a fine fiber about 0.5 mm. in diameter. This sample is situated centrally inside a short closed cylinder and a fine pencil of monocromatic radiation bathes the fiber. Situated radially around the sample is a photographic film. Diffrac-


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| Automatic Quick-Lime Hydrators | Shaking-Chute and Chain Conveyors | Open-Hearth Steel Castings | Electric Locomotives and Larrys |

tion cones of radiation are given off by the sample and cut the film in arcs. These arcs appear on the developed film and are measured and computed in terms of relative intensity and equivalent "d" values.

This procedure, however, is subject in practice to several errors that can be partially compensated for.

Recently a new type of instrument has become commercially available that makes use of a Geiger-Muller counter instead of film. This instrument is known as a Geiger Counter X-ray Spectrometer and largely elimates the errors that occur in the employment of the film technique.

Instead of the customary camera geometry, a focussing condition is employed, where a flat powder layer is irradiated by a divergent beam instead of a fine pencil.

The diffracted beam converges from the specimen to an acceptance slit at the mouth of a Geiger tube situated on an analyzer arm that move radially around the specimen. The arm is driven by a motor and is electrically connected to the chart drive system of a fast strip chart recorder so that the angular displacement of the arm is laid out along the chart length.

Radiation received by the Geiger tube is electrically modified so that the pen displacement of the recorder is proportional to the radiation intensity received. Thus the finished chart will represent an automatic record of intensity distribution versus angle, which of course can be converted to "d."

Using the Geiger-Counter Spectrometer it is often possible to determine as little as 1 percent of a substance in a sample and the quantitative accuracy can also be 1 percent or better. This, of course, is better than most wet or other analytical methods making it a useful tool for plant control or research.

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N. T. Farinacci, Scien-Tech, and F. G. Firth, North American Philips Co., before Scientific Section, Tenth Annual Convention Toilet Goods Association, New York, May 17, 1946.

## WARTIME DISCOVERIES WITH IMPORTANT APPLICATIONS

It is a seemingly irrational commentary on human achievements to note that some of our greatest blessings have been the product of war. The recent conflict should be no exception, and the great crop of military developments of World War II must be recognized as containing inherent benefactions which their martial purpose had concealed.

Though it is difficult for the non-expert to appreciate the derivation of peacetime benefits from the tools of war, such things can have important technical and other professional application. Consider the medical aspects of chemical warfare developments, for example:

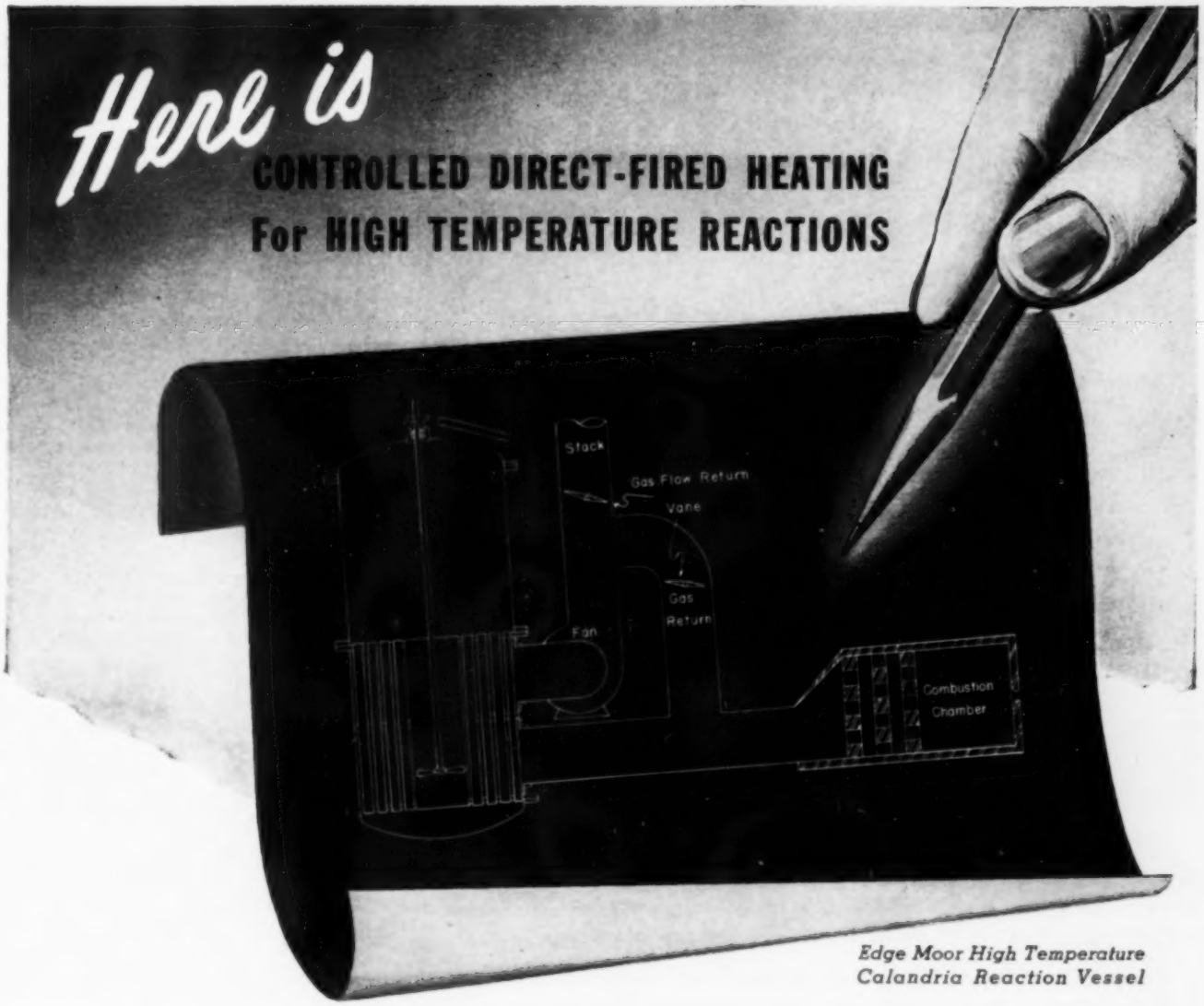
There were five wartime discoveries in this line, made possible by research chemists and biological investigators, which have long range and important humane application.

The first and foremost find involves BAL, which takes its name from British development of its anti-lewisite action. It has been found to be a life-saving medication in treatment of persons poisoned with arsenic or mercury.

This compound was discovered by the

# *Here is*

## CONTROLLED DIRECT-FIRED HEATING For HIGH TEMPERATURE REACTIONS




*Edge Moor High Temperature Calandria Reaction Vessel*

For any chemical reaction that can take place in metal and which requires heating at temperatures higher than that of steam, Edge Moor engineers have developed a direct-fired system. It combines efficient oil heat utilization with the finer control features of the most expensive installations.

The system is composed of but two parts —a separate combustion chamber arranged to supply a uniform amount of heat, and a calandria vessel having an induced draft fan and by-pass system for mixing the furnace and exhaust gases. Through the use of simple control instruments a constant volume of gas at any predetermined temperature is drawn through the vessel to give a highly uniform heat transfer rate and economical use of the heat from the oil.

We solicit any production problems involving reactions, evaporation, heating, cooling, or any of their combinations. Edge Moor engineers are prepared to discuss the application of calandria vessel systems for their solution. For preliminary information write for descriptive literature.

*Process Equipment Fabricators*

**EDGE MOOR** IRON WORKS, INC.

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*BRANCH OFFICES: New York 1, N.Y., Empire State Bldg., Chicago 2, Ill., One No. La Salle St.*

British and manufactured in the United States by the Du Pont company. As a result of chemical skill, a pure compound was made available which could be injected into the human body. Large stocks furnished the Army for protection against heavy metal poisoning from potential war gases will now be made available to the civilian economy and will be invaluable in treatment by physicians.

Second group of chemical compounds synthesized by the chemists of National Defense Research Committee for the Chemical Warfare Service, known as the nitrogen mustards, have been shown by military and civilian medical investigators to have such positive effects on certain forms of cancer that further vigorous study will be pushed.

Third medical contribution concerns diisopropyl fluorophosphate which was produced by NDRC chemists. Physicians working for CWS have found probable beneficial effects of this compound in the treatment of the eye condition, glaucoma. It is also being investigated for the treatment of myasthenia gravis.

The fourth discovery holds promising medical application in cases of poisoning from cyanide. The medical research staff of CWS has shown that this concoction seems to counteract cyanide and may serve as an effective remedy.

A fifth compound developed and produced by NDRC chemists is the rodenticide 1080. It was by far the best rat poison tested by the Fish and Wildlife Service.

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Robert P. Patterson, Secretary of War, before the American Chemical Society, Atlantic City, April 8, 1946.

## IMPURITIES CATALYZE ISOMERIZATION

Impurities that lurked unsuspected in butane and pentane, and in the catalysts with which they were treated, were real though unrecognized heroes in the wartime aviation gasoline production program.

Isomerization was one of the big three processes upon which the success of the aviation gasoline program depended. The others are catalytic cracking and alkylation. The function of the isomerization process in the war program was two-fold: first, conversion of normal butane to its isomer as charge stock for alkylation; second, isomerization of normal pentane to increase the octane rating and improve the front end boiling range of the aviation motor fuel.

The attack on Pearl Harbor placed on the research chemists, development engineers and production men of the oil industry the sudden duty of producing fantastic quantities of 100-octane gasoline and in the shortest possible time. The problem was to convert butane into its isomer in sufficient quantity to keep the alkylation plants built and building, operating at top capacity. The isomerization process took on new importance.

Working on the isomerization reaction in laboratory and pilot plant, the inventors had not waited to obtain chemically pure materials but had made use of the commercial normal butane with the aluminum chloride and hydrogen chloride which were immediately available.

The process worked; a number of isomerization plants were rushed to completion to

convert butane and pentane to their isomers as components of aviation gasoline.

A laboratory study of the reaction with the view to improving its performance was made. Chemically pure materials were obtained and careful experiments were made in high vacuum equipment. The reaction did not work. It was discovered that the process would not go unless the materials entering into the reaction contained minute traces of impurities. Presence of oxygen from the air in proportions less than 1 part in 10,000, a trace of olefins or water, make all the difference between success and failure. The manner in which the impurities operate was determined by the use of deuterium as a tracer.

Herman Pines and R. C. Wackher, Universal Oil Products Co., before the American Chemical Society, Atlantic City, April 12, 1946.

### BUTYL INNER TUBE PERFORMANCE

OVER-THE-ROAD tests being run at San Antonio, Tex., on Stanco test cars using passenger size tires under conditions of 10 percent overload and operating at 60 m.p.h., 24 hr. per day, 5 days per week reveal the following fact: butyl inner tubes are approximately eight times better than natural rubber tubes in their air-holding capacity under these severe test conditions.

Because of this property of butyl inner tubes new test procedures have been developed, making it possible to study the effect of maintenance of proper inflation pressure on tire performance. Results indicate that the maintenance of proper inflation pressure, afforded by butyl tubes because of their superior air retention, will result, under these severe test conditions, in an increase in tread life of approximately 10 percent. Results have been obtained at both 60 and 40 m.p.h.

The superior retention of physical properties of butyl compared with natural rubber under severe laboratory aging conditions has been translated to service aging in actual over-the-road performance. Road tests indicate that the superior retention of properties on aging of butyl yields an inner tube exhibiting increased puncture and blow-out resistance.

I. E. Lightbown and L. S. Verde, Stanco Distributors, and J. R. Brown, Jr., Esso Laboratories, before Division of Rubber Chemistry, American Chemical Society, Atlantic City, April 11, 1946.

### HYPOTHESIS ADVANCED FOR CRUDE OIL FORMATION

MANY attempts have been made to explain the manner in which petroleum is formed in the earth. Early research indicated that most petroleum orginates in the remains of plants and animals which have been deposited on the ocean bottom and which have then been buried by layers of mud or sand. High temperatures and pressures were originally thought to contribute the energy required to convert this material into oil. Investigations about ten years ago proved, however, that oil is formed at temperatures too low to permit this conversion.

Recently, it has been proposed that bacterial action or the energy from the high-speed particles released by radioactivity may play an important role in converting proto-

*New*

# ELECTRONIC RESISTANCE THERMOMETER

*for Chemical Processing*


## THE BAILEY PYROTRON

As a resistance thermometer the Pyrotron indicates, records and controls temperatures between -100°F and 1200°F. It simultaneously records as many as four temperatures on its 12-inch chart, or may record and control as many as two temperatures.

An independent continuously connected measuring circuit serves each recording unit. These circuits are kept in continuous balance by sturdy motion-free electronic detectors which do away with the delicate parts and "step by step" action of galvanometer type instruments.

Indicating, recording and controlling instruments are furnished in rectangular casings as illustrated. Indicating and controlling instruments are furnished in 12-inch round type casings.

## CHOICE OF THREE CONTROLS

Bailey Pyrotrons are furnished with the following types of Automatic Control:

**1. AIR OPERATED**—Uses standard Bailey Pilot Valves, air relays, control valves and control drives. Operates by compressed air at 35 lb. pressure.

**2. ELECTRONIC**—Uses standard electronic control panel operated from a control bridge in the Bailey Pyrotron.

**3. ELECTRIC CONTACTS**—Uses micro switches on slidewire unit or electronic relay operated from control bridge in the Bailey Pyrotron. P-5

## UNUSUAL FEATURES OF THE BAILEY PYROTRON

Suitable for severe service where vibration and shock exist.

Measuring circuit operates from instrument power supply eliminating need for standard cell and dry battery.

Sturdy electronic system maintains continuous balance.

Motor drive furnishes abundant power to operate recorders, controllers and alarm switches.

Two recording controllers may be housed in one casing.

Electronic units may be interchanged without disturbing instrument calibration.

*For details, request Bulletin 230-A "Bailey Pyrotron Electronic Resistance Thermometer".*
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*Controls for Processing*

TEMPERATURE
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% OXYGEN
% COMBUSTION
FLOW
LEVEL
DENSITY
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plasm, proteins, fats, and other complex substances into the constituents of crude oils. Research by the Geology Department at MIT has shown that there may be sufficient radioactivity in the materials of oil fields to effect this conversion over a period of ten million to one hundred million years.

Among the compounds isolated from ocean bottom muds have been a number of fatty acids. When certain of these acids were exposed to bombardment by alpha particles from radioactive disintegration in the laboratory, they were converted into straight chain hydrocarbons which make up the greatest proportion of naturally occurring petroleums.

The research has shown that not only straight chain but even cyclic hydrocarbons can be produced by the effects of radioactivity. Work is now in progress to determine the manner in which complex organic substances are transformed by means of radioactivity.

These changes in organic compounds have been brought about by bombardment or radiation under laboratory conditions. Whether similar conversions may take place in the organic material present in oil fields to form appreciable quantities of petroleum is as yet unknown. The radioactivity of earth materials is now being measured and in time, as this study progresses, some definite idea will be obtained as to the quantitative importance of radioactivity in the formation of crude oil.

I. A. Breger, C. W. Sheppard and V. Burton, Massachusetts Institute of Technology, before the Organic Division, American Chemical Society, Atlantic City, April 8, 1946.

### DESALTING SEAWATER

BASIC process involved in the Permutit Seawater Desalting Kit developed for the armed forces is a combination of cation exchange and precipitation in which the principal chemical ingredient is a silver alumino silicate. This insoluble substance exchanges its silver ion for the sodium ion in solution, the released silver reacting with the chloride ion to produce the insoluble AgCl precipitate. Thus, both the cation and anion of the NaCl are insolubilized and retained in the mass of material which is then strained out of solution by a special cotton filter sealed into the bottom of the reaction bag.

H. L. Tiger, V. J. Calise, S. Sussman and M. Lane, The Permutit Co., before the Division of Water, Sewage and Sanitation Chemistry, American Chemical Society, Atlantic City, April 9, 1946.

### INCREASED OCTANE BY POLYTREATING

POLYTREATING employs solid phosphoric acid catalyst to improve the octane number of gasoline by removing olefins, which are of low lead susceptibility, or converting the olefins to aromatics or paraffins, which are highly lead-susceptible.

Using a gasoline of about 300 deg. F. end-point, pressures ranging from 400 to 800 psi. and temperatures from about 350 to 550 deg. F. were employed. As the operating temperature is increased, the yield of gasoline fraction is decreased. This is accompanied by a decrease in olefin content and an increase in octane number. Satisfactory increase in octane number is produced in

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*the most versatile adsorbent for solving problems of*

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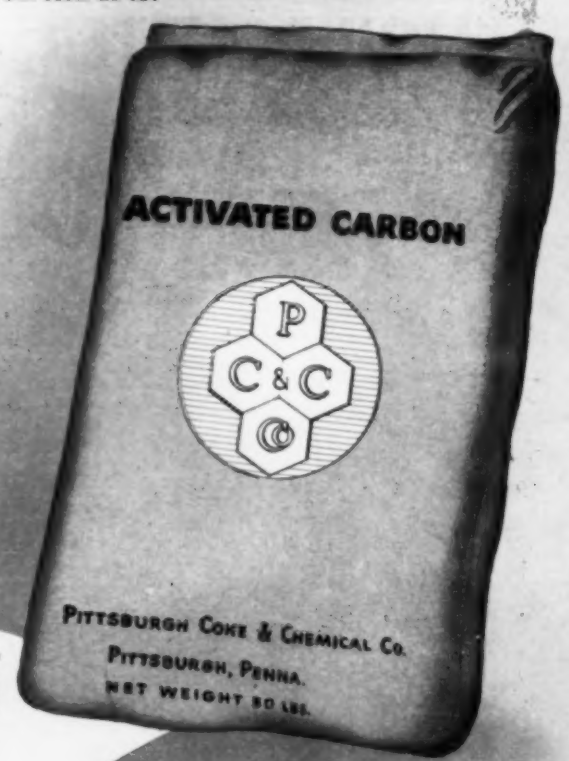
**Isolation of Organic Chemicals or Drugs**
**Catalysis or Catalyst Carriers**

The technology of modern manufacturing embraces, in ever increasing degree, application of the science of chemistry as well as the mechanical forces of physics. Likewise the accomplishment of a physical act through a chemical medium becomes more and more common practice. Solving problems of adsorption is a typical sample of this method.

Of the various adsorptive materials, Activated Carbon has proved to be exceptionally adaptable and versatile. It has high adsorptive capacity, is chemically stable, readily regenerated and can be made in a variety of forms and sizes to meet specific needs. Moreover it can be produced relatively economically on a tonnage basis for large scale applications.

If your manufacturing process requires the use of an adsorbent you should investigate the merits of Activated Carbon. Pittsburgh Coke & Chemical Company has the technical "know-how" and the production facilities to help you. Ask us to!




**Pittsburgh Coke & Chemical Company**
Grant Building — Pittsburgh, Pennsylvania

the pressure range 400-1,000 psi., and the aromatic components of the gasoline are virtually unchanged during the polytreating reaction.

Results of a number of laboratory and pilot plant runs have shown that optimum conditions of operation for polytreating $C_4$-350 deg. F. gasoline are 600 psi., a space velocity of about 1 and temperature of approximately 510 deg. F.

The polytreating reaction produces more saturated gasoline and a residue boiling above the gasoline range. The amount of residue formed depends upon the olefin content of the charging stock and the severity of polytreating.

The residue is very susceptible to catalytic cracking and produces gasoline yields of 87-88 percent. The gasoline is similar in octane rating to the first stage gasoline. Condensable gas yield is close to 8 percent. Noncondensable gas loss is small.

The condensable gas contains a large proportion of olefins which, when processed in polymerization units, add substantially to the over-all yield of high octane gasoline.

V. Haensel and V. N. Ipatieff, Universal Oil Products Co., before the American Chemical Society, Atlantic City, April 11, 1946.

## IMPROVED TIRES IN PROSPECT

We can expect that improved rubbers will be made within a reasonable time. Superior synthetic fibers and cords will be developed, and improved carbon blacks or other reinforcing materials will be brought along also. By such improvements we can reduce the heat developed in a tire which must be sturdy enough to wear for 100,000 miles—as long as the average owner keeps his car. The 30,000 to 50,000 mile tire expected today, depending on operating conditions, has been perfected chiefly through improved synthetic reinforcing compounds and fabrics. It is now significant that the remaining major material—the rubber—has been made by synthetic processes.

R. P. Dinsmore, The Goodyear Tire and Rubber Co., at automobile industry's Golden Jubilee celebration, Detroit, May 28, 1946.

## COMMERCIAL NITRATION OF NATURAL GAS

Nitroparaffin developments of the past ten years have shown that the first member of the series, nitromethane, has many uses for which the higher homologues are unsuited. For example, it is the only mononitroparaffin which can be detonated with a cap. It is a high explosive much more powerful than TNT but even harder to explode by accidental shock. It has three replaceable hydrogen atoms while the others have two, one, or none.

Nitromethane has been more available than the other members of the series since 1872, when it was first made from acetic acid by chlorination, neutralization and treatment with sodium nitrite. Therefore, it has been more widely studied and more of its derivatives are known than of its homologues. Also, nitromethane is an excellent selective solvent for doing such jobs as separating petroleum oils into good and poor lubricating fractions.

Commercial nitration of propane yields

relatively small amounts of nitromethane. This process has provided sufficient material for experimental studies in the use of nitromethane for such purposes as launching flying bombs. It has long been evident, however, that the best way to produce nitromethane in large quantities would be by the action of nitric acid on natural gas, which consists of approximately 85 percent methane. These cheap gases are available at a cost of about $2 per ton (3c. per M cu. ft.) in Texas. Plants constructed during the war to produce nitric acid for the manufacture of TNT are now standing idle because the peacetime demand for this acid is not nearly so great.

The difficulty in the production of nitromethane has been that yields have always been low when methane is treated with nitric acid. By employing moderate pressure, 100 psi., the yield was very considerably increased, and brought up to about 80 percent that obtained with propane.

As a result of this research, nitromethane is potentially available commercially on any scale desired and at a relatively low production cost.

H. Shechter, H. B. Hass, L. G. Alexander and D. B. Hatcher, Purdue University, before the Division of Industrial and Engineering Chemistry, American Chemical Society, Atlantic City, April 11, 1946.

## SIGNIFICANCE OF GERMAN ACETYLENE DEVELOPMENTS

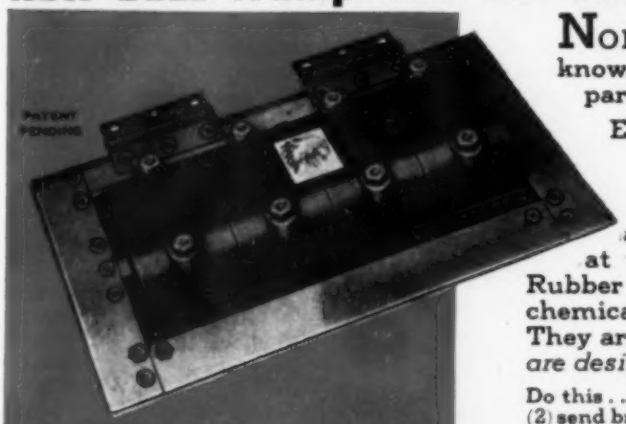
Advances in the field of acetylene were among the most striking wartime achievements of German industry. In addition to synthetic fibers, the Germans obtained from acetylene many products which have important potential uses in the manufacture of plastics and plasticizers and in the rubber industry.

The reason the Germans relied on acetylene to provide raw materials for a large part of their chemical industry was the country's lack of petroleum and natural gas. In the United States, where petroleum and natural gas are plentiful, it has not been so necessary to utilize acetylene for chemical production. Where we have built up a large part of our organic industry based on ethylene from petroleum, the Germans were forced to obtain ethylene by hydrogenating acetylene made from coal.

Although economical processes for producing acetylene have been the goal of many research efforts, only two methods are in large-scale use at present, namely, production through calcium carbide and electric arc cracking of light hydrocarbons such as methane and ethane. Little interest has been shown in the arc process in the United States, although it has been thoroughly studied, because it has not appeared attractive commercially. Even in Germany, the apparent cost of acetylene by this process was substantially the same as by the use of carbide. Power consumption was just as high and purification equipment and costs were very large. This latter difficulty is inherent in all processes so far proposed for acetylene manufacture from petroleum sources.

In Germany, the number of chemical compounds made from acetylene was very large. Many of these are essentially made from ethylene produced by hydrogenating acetylene and hence are of little interest to

# How Does Tramp Iron and Steel Get Into Chemicals In Process?




**NOBODY** knows. But *everybody* processing chemicals knows that wires, nails, nuts, bolts and minute ferrous particals must be eliminated from the conveyor lines.

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LIQUIDS MAGNESIUM
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PHENOLIC PLASTICS-RESIN
PHOSPHATES POWDER
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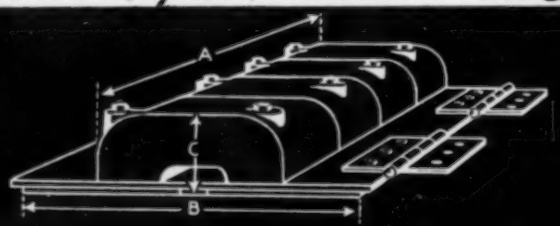
PULP SULPHITE
RAW SUGAR RUBBER
SALT SLUDGE SOAP
SOYBEAN OIL SULPHUR


| A Width | B Length | C Thickness | Weight |
|---|---|---|---|
| 4" | 7" | 2 1/16" | 6 lbs. |
| 6" | 7" | 2 1/16" | 9 lbs. |
| 7" | 7" | 2 1/16" | 10 lbs. |
| 8" | 7" | 2 1/16" | 12 lbs. |
| 10" | 7" | 2 1/16" | 15 lbs. |
| 12" | 7" | 2 1/16" | 18 lbs. |
| 14" | 7" | 2 1/16" | 21 lbs. |
| 16" | 7" | 2 1/16" | 24 lbs. |
| 18" | 7" | 2 1/16" | 27 lbs. |
| 20" | 7" | 2 1/16" | 30 lbs. |
| 22" | 7" | 2 1/16" | 33 lbs. |
| 24" | 7" | 2 1/16" | 36 lbs. |
| 30" | 7" | 2 1/16" | 45 lbs. |
| 36" | 7" | 2 1/16" | 58 lbs. |
| 42" | 7" | 2 1/16" | 63 lbs. |
| 48" | 7" | 2 1/16" | 72 lbs. |
| 54" | 7" | 2 1/16" | 81 lbs. |
| 60" | 7" | 2 1/16" | 90 lbs. |
| 66" | 7" | 2 1/16" | 99 lbs. |
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Size magnet required is determined by flat inside measurement (at right angle to material travel) at point of installation.

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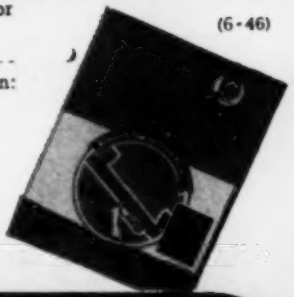

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us. Such products as glycols, styrene, etc., can be made more cheaply here from petroleum ethylene. Similarly we have relatively little interest in the manufacture of butadiene from acetaldehyde or from formaldehyde and acetylene, as we have much cheaper processes available from petroleum. Some of the intermediates produced in these processes, however, are of definite interest for the manufacture of other, and in some cases new, products.

The following are some of the more interesting German developments:

1. Direct vinylation reactions. These involve the reaction of acetylene with alcohols, acids, sulphides and amines to produce vinyl ethers, esters, sulphides and amines. These products have many potential uses, particularly in the manufacture of plastics, plasticizers and rubber tackifiers.

2. Direct carbon-carbon linkage, inserting acetylene into molecules such as aldehydes, ketones, etc. This yields highly unsaturated and reactive compounds which can be processed further to produce butadiene, acrylic acid, acrylonitrile, adipic acid, mono, di and trihydroxy aliphatics, etc.

3. Carbon monoxide addition to such materials as acetylene, tetrahydrofurane, etc., to give adipic and acrylic acids.

4. Development of new synthetic fibers and methods for producing intermediate products.

5. Manufacture of a number of rather new intermediates on a large scale, such as propargyl alcohol, butynediol, tetrahydrofurane, dihydrofurane and butyrolactone.

Of these many developments, it appears probable that interest in this country will center around vinyl ethers, carbon monoxide addition, synthetic fibers and the manufacture of new products from the various intermediates. However, in many cases, alternate and more economical methods of production of the intermediates will be found using petroleum or farm products as raw materials.

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Carl C. Monrad, Carnegie Institute of Technology, before the Chicago Section, American Chemical Society, April 26, 1946.

# FOREIGN LITERATURE ABSTRACTS

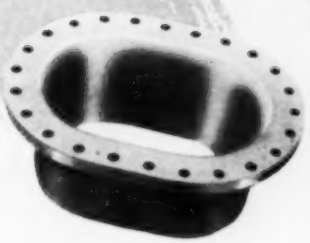
## ELECTROLYTIC POLISHING OF CADMIUM

In electrolytic polishing of cadmium the electrolyte used is an aqueous solution of potassium cyanide (120 g. per liter) with cadmium hydroxide (20 g. per liter) added. The process is carried out at ordinary temperature without agitation. The cathode is an iron plate of 10 sq. cm. or, better still, two iron plates of 5 sq.cm. each located on either side of the 4 sq.cm. anode mounted in the center of the tank. The anode, prepared and cleaned, is mounted in the tank and the tension or intensity necessary for polishing established, depending on whether potentiometric or direct wiring is used. The intensity (or the tension) is watched at first in order to keep it constant. The electrolysis can be interrupted and resumed without trouble, providing that the anode is left for

# LENAPE

## Connections and Openings for Pressure Vessels

*Heavy Wall Welding Necks*



*Type RO Manway Neck*

*Reinforcing Nozzle*

Ease of fabrication — economy in first and installed cost — a wide selection of available types — these are but three of the significant reasons why designers and fabricators long have favored Lenape press-forged seamless welding necks, nozzles, manways, and handholes.

The Lenape press-forging technique offers unusual versatility in the production of uncommon shapes as well as standard products.

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**PROCESS INDUSTRIES**

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- Heaters
- Coolers
- Exchangers
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- Condensers
- Autoclaves
- Reboilers
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- Digesters
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several moments without current in the tank before resumption. Electrolysis can be continued as long as necessary. When the polishing is completed, the anode is withdrawn without interrupting the current, washed in a stream of water and dried. A satisfactory polish is obtained by operating under a tension of 4 to 5 volts, current density being from 12 to 25 amperes per sq.dm. The brilliant appearance of the surface is obtained from the beginning of the electrolysis, and 00 emery scratches are totally eliminated in 15 min. The operation can also be conducted with liberation of gas and in that case the distance of the electrodes can vary much more, a distance of 20 to 30 mm. between cathode and anode giving good results. The different factors which affect the result of the operation of electrolytic polishing of cadmium are: tension applied and current density, concentration, distance of the electrodes, agitation, influence of the carbonates, influence of dissolved cadmium.

Digest from "Electrolytic Polishing of Cadmium", *Bull. Soc. Chim. France* 11, No. 11-12, 568-572, 1944; *Chimie et Industrie* 55, No. 2, 121, 1946. (Published in France.)

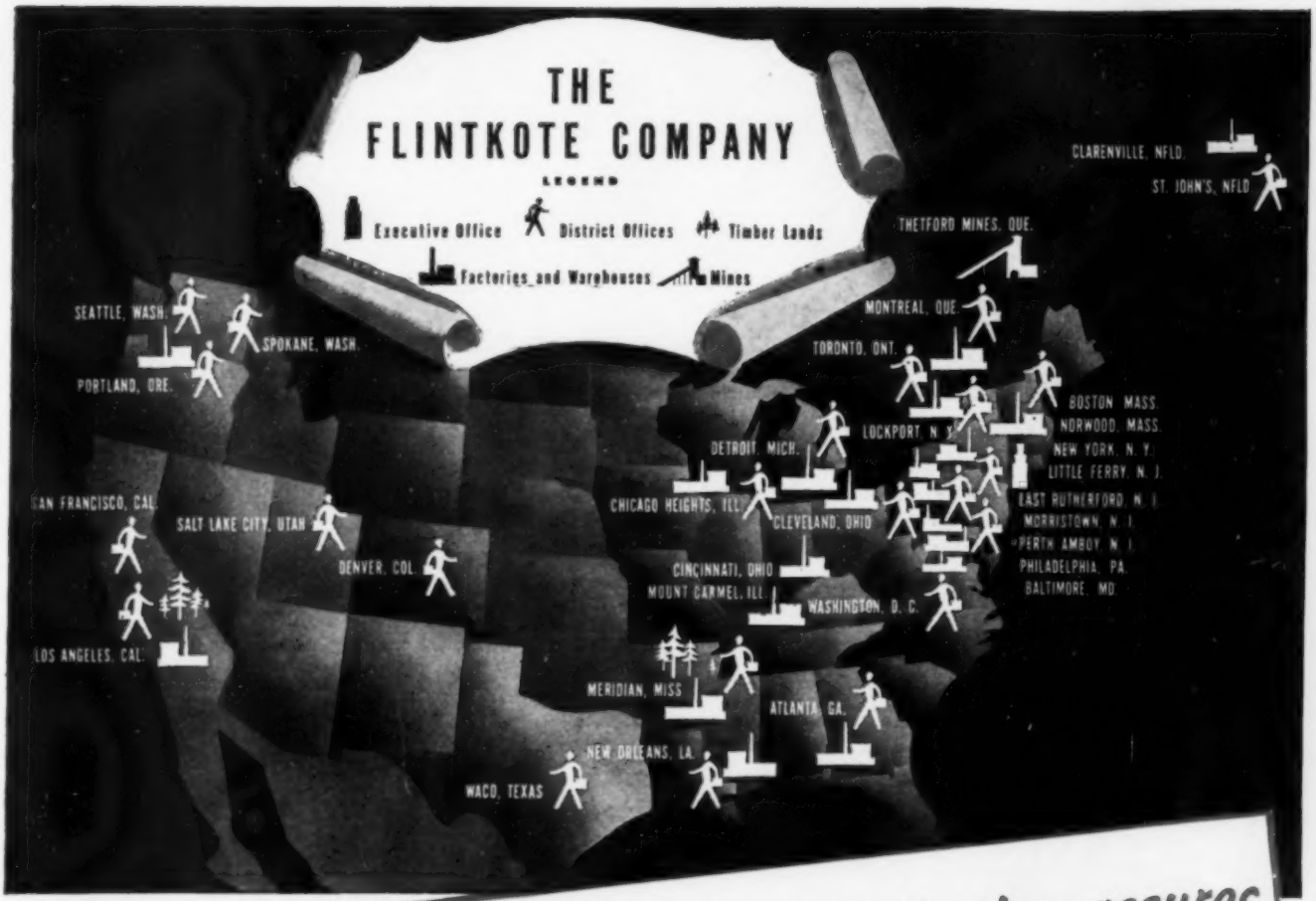
## NITRO COLORING MATERIALS FOR RAT POISON

Use of nitro coloring materials for extermination of rats is a recent development and it is now known that such coloring materials are far more powerful than any of the other materials in present use for this purpose, such as strychnine, phosphorus, thallium salts, arsenic and its compounds, squill, barium carbonate, fluorine compounds and sodium nitrate. Non-sulphonated nitro coloring materials are of more of less toxic nature. The presence of the sulpho group ($-SO_3H$) takes all physiological activity from the molecule. The physiological activity of di-nitrated phenols in the 2,4 position is far greater than that of the mono- or tri-nitrated analogs. Particular interest was therefore taken in the following compounds and detailed laboratory experiments were conducted to determine their action and effectiveness: 2,4-dinitrophenol, 2,4-dinitrocresol, 2,4-dinitro-alpha-naphthol and 2,4-dinitro-alpha-naphthol sulpho acid.

Digest from "Nitro Coloring Materials and Their Special Applications. III. Rat-killing Coloring Materials" by I. A. Pastac, *Chimie et Industrie* 53, No. 1, 19-26, 1945. (Published in France.)

## CLAYS FOR GASOLINE DESULPHURIZATION

Twelve samples of clays from four different regions on the Apsheron peninsula in the USSR were tested for suitability for catalytic desulphurization of gasoline, and optimum conditions for the process were determined. Three of the samples were found capable of reducing the sulphur content of gasoline from 72 to 75 percent in a continuous run lasting 15 hours at 300 deg. C. At 400 deg., almost 85 percent desulphurization was achieved on gasoline having an initial sulphur content of 0.059 percent. A temperature of 300 deg. was considered preferable, however, since partial cracking may take place at the higher temperature. Activation of the clay by heating at 400 deg. for 3 hrs. did not affect its desulphurization action. The same clay samples were found to remove sulphur from different gasolines in varying degrees, as shown by experiments conducted

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Flintkote Hot Melt Compound, for example, will give you acid resistance or vapor seal in certain coating or laminating jobs. FLINTDEK† provides a grease-proof, oil-proof, non-slip surface for floors and steps. A Flintkote SYNTEX* aqueous dispersion of rubber or resin, or a synthetic latex compound may be just what you are looking for.

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•

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at 300 deg. C., atmospheric pressure and an hourly space velocity of 1 volume of gasoline per volume of clay. Only 30-50 percent sulphur removal was achieved in the gasoline having a low sulphur content originally (0.0118 to 0.0175) while those containing 0.059-0.093 percent sulphur underwent from 72 to 75 percent desulphurization. The difference also may have been due partly to the sulphur compounds present in them. The octane number of the gasoline rises by one unit in the presence of 3 cc. TEL for every 0.01 percent sulphur removed.

Digest from "Catalytic Desulphurization of Gasoline" by I. M. G. Namedli, *Zhurnal Prikladnoi Khimii* **18**, 62-8, 1945. (Published in Russia.)

## DESTRUCTIVE HYDROGENATION

EFFECT of structure on the rate of destructive hydrogenation of ten typical compounds is shown in the attached table, which gives the relative rates of decomposition of hydrocarbons in destructive hydrogenation in the presence of 5 percent molybdenum sulphide under an initial pressure of 80 atmospheres. Cyclic hydrocarbons without side chains decompose at considerably slower rates than aliphatics. Relative rates of decomposition of molecules having approximately equal numbers of carbon atoms decrease in the following order: normal paraffins, polynuclear naphthenes, partly hydrogenated fused-ring aromatics, fused ring aromatics, in other words, the rate of decomposition varies directly with the proportion of hydrogen in the molecule. Increase in the rate of decomposition with increase in the molecular weight (or number of rings in the molecule) was found to be characteristic for all the cyclic hydrocarbons studied. Each additional ring in the molecule accelerates the reaction 5 to 10 times in the case of aromatics and 16 times in the case of naphthenes. These regularities hold for the temperature range of 380-475 deg. Within 380-420 deg. the temperature coefficient of the rate of destructive hydrogenation is 1.85-2.05, the apparent energy of activation 55,000-65,000 cal. per mole. Within 420-475 deg. the corresponding values are 1.6-1.75 and 48,000-58,000. Although there are great differences between the absolute values of cracking velocity constants and destructive hydrogenation constants, relationships between rates of conversion of the various classes are qualitatively the same for both processes. The instability of normal dodecane, the exceptional stability of naphthalene, and the intermediate positions of decalin and tetralin are observed in both cases.

Digest from "Rates of Decomposition of Hydrocarbons in Destructive Hydrogenation. III" by A. V. Lozovoi and S. A. Senyavin, *Zhurnal Prikladnoi Khimii* **18**, 43-9, 1945. (Published in Russia.)

**Relative Rates of Decomposition of Certain Hydrocarbons**

| Hydrocarbon | 380 deg. | 420 deg. | 475 deg. | Mean value |
|---|---|---|---|---|
| Naphthalene | 1.00 | 0.11 | 0.43 | 0.27 |
| Tetralin | 1.00 | 1.00 | 1.00 | 1.00 |
| Decalin | 2.90 | 1.52 | 2.20 | 2.27 |
| Anthracene | 3.13 | 1.71 | 1.70 | 2.18 |
| 9, 10-Dihydroanthracene | 3.13 | 1.76 | 2.66 | 2.52 |
| Octahydroanthracene | 3.83 | 3.10 | 5.23 | 4.05 |
| Perhydroanthracene | 39.35 | 33.51 | .... | 36.43 |
| Phenanthrene | ..... | 3.75 | 2.46 | 3.11 |
| 1, 2-Benzanthracene | ..... | 11.18 | .... | 11.18 |
| Normal dodecane | 66.1 | 47.35 | .... | 56.77 |

# CHEMICAL ENGINEER'S BOOKSHELF

LESTER B. POPE, Assistant Editor

## CORROSION CONFAB

SYMPOSIUM ON STRESS-CORROSION CRACKING OF METALS. *Edited by Carter S. Cole. Published jointly by American Society for Testing Materials and the Institute of Metals Division, American Institute of Mining and Metallurgical Engineers.* 495 *pages.* $5 *to members,* $7.50 *to nonmembers.*

STRESS-CORROSION cracking has been the subject of research and speculation for three decades. It is a phenomenon of major engineering significance and considerable theoretical interest. Many puzzling and apparently contradictory facts have been uncovered, and the theories advanced to explain the phenomenon have been varied and frequently conflicting.

To meet the need for a thorough and critical review of the field, ASTM and AIME sponsored a joint symposium on stress-corrosion cracking. It was held in Philadelphia in November 1944. The present volume is a compilation of the papers and discussions presented there. An author index has been added.

The whole field of stress-corrosion cracking was thoroughly covered at the three-day meeting. There were papers on the theory of stress-corrosion cracking, test methods, brass and other copper-base alloys, light alloys, stainless steel, galvanized steel, bridge wire, and a series of other materials including nickel and nickel alloys, lead alloys, and low-carat gold. In all, 28 papers were presented.

It is generally recognized that these papers represent the most extensive existing compilation of present-day knowledge on the resistance of metals to conditions of combined stress and corrosion.

## PLASTICS CATALOG

MODERN PLASTICS ENCYCLOPEDIA. *Plastics Catalog Corp., New York.* 1,389 *pages. Price.* $6.

THIS YEAR'S catalog is even more colorful and elaborate than its predecessors. This applies both to editorial material and advertisements. Certain of the sections are of particular interest to the chemical engineer: (1) Facts and figures of the industry for 1944 and 1945, (2) technical data includes a large volume of information on most of the plastic materials, (3) the usual articles on each of the resins, (4) synthetic resin coatings for textiles, paper, metals, etc., (5) recent developments in resin treatment of fibers, (6) the customary articles dealing with the various synthetic rubbers including silicone and cyclorubber, and (7) the appendix with its glossary, list of producers of materials and chemicals, equipment and supplies, list of courses in plastics, trade associations and list of trade words.

## SOUND AND PRACTICAL

MODERN PLASTICS. *By Harry Barron. John Wiley & Sons, New York.* 680 *pages.* $7.50.

*Reviewed by Chaplin Tyler*

HARRY BARRON is well known for his numerous contributions to the technical literature of synthetic resins and plastics and as the author of two earlier books "Modern Rubber Chemistry" (1937) and "Modern Synthetic Rubbers" (1942 and 1944). The present book "Modern Plastics" was published originally in 1945 in England.

"Modern Plastics" is neither an elementary text nor a handbook; it occupies an intermediate position and as such should have good acceptance among chemists and engineers concerned with the manufacture and application of plastics. Part I is concerned with the scope of the plastics industry, the raw materials used, and the fundamentals of polymerization. Part II deals with thermosetting resins and their formulations for various applications such as varnishes, cements, molding compositions, castings, and laminates. Part III deals with the cellulose plastics. Under Part IV, entitled "Vinyl Plastics," various materials are discussed including polyethylene, polystyrene, polyvinyl chloride and copolymers, polyacrylics, polyvinyl acetate, polyvinyl alcohol, and polyvinyl acetals. Part V is a catch-all section which covers polyamides, alkyds, and protein materials. Part VI covers high-frequency heating techniques, analytical procedures, and physical testing techniques.

As is the case with all books in extremely fast-growing and fast-moving fields, coverage cannot be complete nor strictly up-to-date, since important progress takes place in a matter of months. Nevertheless, Dr. Barron has handled the subject well. The book has a practical flavor yet is sound theoretically.

### RECENT BOOKS RECEIVED

**Chemotherapy.** Ed. by W. H. Powers. Reinhold. $3.25.

**Encyclopedia of Hydrocarbon Compounds; $C_1$ to $C_5$.** By J. E. Faraday. Chemical. $15.

**German for the Scientist.** By P. F. Wiener. Chemical. $3.50.

**Introduction to Emulsions.** By G. M. Sutheim. Chemical. $4.75.

**Luminous Tube Lighting.** By H. A. Miller. Chemical. $3.50.

**Personality and English in Technical Personnel.** By P. B. McDonald. Van Nostrand. $3.75.

**Physical Methods of Organic Chemistry. Vol. II.** Ed. by A. Weissberger. Interscience. $8.50.

**Research and Regional Welfare.** Ed. by R. E. Coker. University of North Carolina Press. $3.

**Rubber in Engineering.** Chemical. $5.50.

**Textbook of Biochemistry.** By P. H. Mitchell. McGraw-Hill. $5.

**Vapor Adsorption.** By E. Ledoux. Chemical. $8.50.

## REPORTING EVIDENCE

ATOMIC AND FREE RADICAL REACTIONS. *By E. W. R. Steacie. Reinhold Publishing Corp., New York,* 548 *pages.* $8.

*Reviewed by F. C. Nachod*

ALL who have been concerned with problems concerning the kinetics of gas phase reactions will have been disappointed at one time or another about the fact that information on this subject is widely scattered throughout the literature and may be found under such headings as kinetics, photochemistry, catalysis, pyrolysis and so forth. In the author's own words: "This book is an attempt to bring together such data, and to treat the reactions of atoms and radicals in their own right, rather than as an incidental part of the mechanism of more complex changes." To call it an attempt speaks very much for Dr. Steacie's modesty. In the reviewer's opinion this goal has been achieved very successfully.

Dr. Steacie starts out with an introductory chapter, followed by a chapter on experimental methods. This bespeaks the mature experimenter and expert in the field. Graduate students and industrial investigators can learn much about technique in these sixty-odd pages. The next three chapters are devoted to free radical mechanisms in thermal decomposition, polymerization, and photochemistry respectively. The balance of the text (chapters 6 to 14) deals with specific systems. A reaction index, a table of activation energies and author and subject indexes are appended.

In a field such as the present there is ample space for controversial issues. It is much to Dr. Steacie's credit that he does not attempt to take sides but assumes the rôle of the reporter and concerns himself only with the experimental evidence. Yet he is not uncritical but points out (see for example p. 290 ff.) where questionable technique may lead to conclusions which are open to challenge.

The text is indeed a fine piece of workmanship and a painstaking assembly of facts, collected by an expert who knows his field well. Dr. Steacie must be congratulated for having rendered such a service to chemistry.

## REFERENCES

BIBLIOGRAPHY ON THE PETROLEUM INDUSTRY. *By E. DeGolyer and Harold Vance. Bulletin 83, School of Engineering, Texas Engineering Experiment Station, Agricultural and Mechanical College of Texas, College Station, Texas.* 725 *pages.*

THIS bibliography on the petroleum industry, containing references arranged chronologically under some 900 different subjects, is

probably the most exhaustive compilation of its kind. Although the authors make no claims for completeness, some subjects are believed to be complete. The number of pages devoted to listings under each of the ten major subject classifications indicates the relative importance of geology and exploration, production, transportation, refining and utilization: General data (20); geographical distribution of petroleum and oil fields (116); physical and chemical properties and methods of testing (28); geology, exploration and prospecting (224); development of deposits (76); production of petroleum, natural gas and related hydrocarbons (92); transportation and storage (46); oil refineries and refining practice (42); utilization of petroleum and its products (6); economics of the petroleum industry (46).

### PHOSPHATES

THE BOOK "Phosphates and Superphosphate," by A. N. Gray, was reviewed on these pages in October 1944 (p. 199). Copies are now available in this country and may be obtained from Interscience Publishers, 215 Fourth Ave., New York 3, N. Y. Price is $7.

## RECENT BOOKS and PAMPHLETS

**Industrial Tacoma.** Published by Tacoma Chamber of Commerce, Tacoma Bldg., Tacoma, Wash. 24 pages. Pamphlet of industrial information, including transportation; freight, water and power rates; taxes and licenses. Contains list of firms engaged in chemical and allied operations in the Pacific Northwest.

**The San Francisco Bay Region as a Factory Location.** Published by San Francisco Chamber of Commerce, 333 Pine Street, Zone 4. 28 pages. A survey of the Bay Region geography, climate, transportation, raw materials, markets, labor, power and fuel, and other pertinent data for manufacturers. Contains graphs, charts, maps.

**California Mineral Production and Directory of Mineral Producers for 1944.** Bulletin 132, published by Division of Mines, Department of Natural Resources, Ferry Bldg., San Francisco. 224 pages; 75 cents. A statistical report containing detailed data on the amount and value of metallic and non-metallic minerals, subdivided as to fuels, metals, structural materials, industrial materials and salines, both by substance and by counties. Treats briefly on the properties and uses of commercial minerals of the state and includes a directory of all producers (except those of natural gas and petroleum).

**Selected List of Publications.** Western Regional Research Laboratory, Albany 6, Calif. 20-page mimeographed bulletin listing available mimeographed material, including journal articles, on freezing preservation and dehydration of foods; enzyme and pharmacological research; fruit and vegetable chemistry and byproducts. Also lists patents.

**A Guide to the Literature on the History of Engineering.** Published by The Cooper Union, New York 3, N. Y. Listing of books in The Cooper Union Library.

**Engineers' Council for Professional Development.** Published by the ECPD, 25-33 West 39th St., New York 18, N. Y. 56 pages. Thirteenth annual report.

**Opportunities for Productive Work Through Mineral Industries Research.** Circular 20, published by School of Mineral Industries, Pennsylvania State College, State College, Pa. 32 pages. Gratis. Illustrated description of the functions of the Mineral Industries Experiment Station.

**The Economic Advantages of Integrated Sea-Air Transportation.** By A. E. Burns. Published by Sea-Air Committee of National Federation of American Shipping, Inc., 2660 Woodley Road N. W., Washington 8, D. C. 14 pages. Advantages are improved service to the consumer of transportation and lower unit costs.

**How to Find a Short.** By Jack Steele. Published by The Norman W. Henley Publishing Co.,

17-19 W. 45th St., New York 19, N. Y. 209 pages; $2. Shorts and other automobile wiring troubles.

**Why OPA Should be Ended.** By J. Howard Pew, president, Sun Oil Co., 1608 Walnut St., Philadelphia 3, Pa. 16 pages. A statement before House Banking and Currency Committee.

**Shell Soldier and Civilian.** Published by Shell Oil Corp. and Associated Companies. A large illustrated book telling the story of Shell's wartime achievements in lubricants, fuels, toluene, rubber, etc.

**Steel In the War.** By Douglas A. Fisher. Published by United States Steel Corp., 71 Broadway, New York 6, N. Y. 164 pages. The record of a basic industry's war accomplishments. A well-told and well-illustrated story.

## GOVERNMENT PUBLICATIONS

The following recently issued documents are available at prices indicated from Superintendent of Documents, Government Printing Office, Washington 25, D. C. In ordering publications noted in this list always give complete title and the issuing office. Remittances should be made by postal money order, coupons, or check. Do not send postage stamps. All publications are in paper covers unless otherwise specified. When no price is indicated, pamphlet is free and should be ordered from the Bureau responsible for its issue.

**Mineral Investigations of the Geological Survey in Alaska in 1943 and 1944.** By John C. Reed. Geological Survey Bulletin 947-A. Price 5 cents.

**Bibliography of North American Geology 1942 and 1943.** By Emma M. Thom. Geological Survey Bulletin 949. Price 70 cents.

**Chromite-Bearing Sands of the Southern Part of the Coast of Oregon.** By Allan B. Griggs. Geological Survey Bulletin 945-E. Price 35 cents.

**Minerals of the Montmorillonite Group, Their Origin and Relation to Soils and Clays.** By C. S. Ross and S. B. Hendricks. Geological Survey Professional Paper 205-B. Price 35 cents.

**Fires, Gases, and Ventilation in Metal Mines.** Metal-Mine Accident-Prevention Course, Section 5. Bureau of Mines, Miners' Circular 55. Price 20 cents.

**Wetting-Agent Concentration in Water Solution Determined by the Drop-Number Method.** By John P. Harmon. Bureau of Mines, Information Circular I. C. 7351. Mimeographed.

**Safe Practices in Mine Hoisting.** By D. Harrington and J. H. East, Jr. Bureau of Mines, Miners' Circular 61. Price 15 cents.

**Minerals Yearbook 1944.** Price $3.00. Clothbound. Bureau of Mines has now published the bound volume of 1944 minerals resources data and the various chapters as separates. In general the separates are 5 cents or 10 cents each.

**Exploration, Composition, and Washing, Burning, and Gas-Producer Tests of a Coal Occurring Near Coaldale, Esmeralda County, Nev.** By Albert L. Toenges, et al. Bureau of Mines, Technical Paper 687. Price 30 cents.

**Concentration of Manganese Ores from Gila, Greenlee, and Graham Counties, Ariz.** By G. M. Potter, A. O. Ipsen, and R. R. Wells. Bureau of Mines, Report of Investigations R. I. 3842. Mimeographed.

**Continuous Hydraulic Classification: Constitution of the Teeter Column Throughout Its Depth.** By G. Dale Coe, I. L. Feld, M. F. Williams, Jr., and Will H. Coghill. Bureau of Mines, Report of Investigations R. I. 3851. Mimeographed.

**Exploration of the Piedmont Manganese Belt, McCormick County, South Carolina, and Wilkes County, Georgia.** By William A. Beck. Bureau of Mines, Report of Investigations R. I. 3858. Mimeographed.

**Investigation of the McLeod Glass-Sand Pits, Wheeler County, Ga.** By W. C. Hudson. Bureau

of Mines, Report of Investigations R. I. 3859. Mimeographed.

**Examination and Treatment of Industrial Magnesium Foundry Wastes.** By O. C. Garst. Bureau of Mines, Report of Investigations R. I. 3860. Mimeographed.

**Investigation of the Miami-West Palm Beach Belt of Silica Sand in Florida.** By W. C. Hudson. Bureau of Mines, Report of Investigations R. I. 3865. Mimeographed.

**Flood-Prevention Projects at Pennsylvania Anthracite Mines. A Preliminary Study.** By S. H. Ash and James Westfield. Bureau of Mines, Report of Investigations R. I. 3868. Mimeographed.

**Recovery and Utilization of Oil from Oil-Field Waste Emulsion.** By Joseph W. Horne, J. Wade Watkins, and Arthur Matzick. Bureau of Mines, Report of Investigations R. I. 3869. Mimeographed.

**Exploration at the Cline Mine, Cabarrus County, N. C.** By William A. Beck. Bureau of Mines, Report of Investigations R. I. 3873. Mimeographed.

**Exploration of the Bear Lodge Fluorite Property, Crook County, Wyo.** By W. C. Dunham. Bureau of Mines, Report of Investigations R. I. 3877. Mimeographed.

**Electronic Chronoscope for Measuring Velocities of Detonation of Explosives.** By C. R. Nisewanger and F. W. Brown. Bureau of Mines, Report of Investigations R. I. 3879. Mimeographed.

**Exploration of the Big Four Zinc-Silver Mine, Summit County, Colo.** By R. B. McCulloch and W. P. Hulcatt. Bureau of Mines, Report of Investigations R. I. 3884. Mimeographed.

**Census of Pulp Mills and of Paper and Paperboard Mills 1945.** Bureau of the Census, Facts for Industry, Series 24-1-4. Processed.

**The Social Impact of Science: A Select Bibliography.** Subcommittee Monograph No. 3, Senate Committee on Military Affairs. Price 15 cents.

**Antitrust Laws with Amendments 1890-1945.** Compiled by Elmer A. Lewis, Superintendent, Document Room, House of Representatives. Unnumbered. Price 20 cents.

**Walsh-Healey Public Contracts Act. Rulings and Interpretations No. 3.** Department of Labor. Unnumbered. Price 15 cents.

**Resale Price Maintenance.** Federal Trade Commission report submitted to Congress. Price $1.50.

**Check List to Help Introduce Your New Industrial Products.** Bureau of Foreign and Domestic Commerce, Economic Series No. 53. Price 10 cents.

**Work Injuries in the United States During 1944.** Department of Labor, Bulletin No. 849. Price 10 cents.

**Aircraft Metals.** Navy Training Courses 1945. Unnumbered. Price 30 cents.

**U. S. Rocket Ordnance—Development and Use in World War II.** Released by Joint Board on Scientific Information Policy. Unnumbered. Price 20 cents.

**The Economy of Puerto Rico.** By Ben Dorfman. U. S. Tariff Commission. Unnumbered.

**Educational Directory 1945-1946. Part III—Colleges and Universities.** Office of Education. Unnumbered. Price 20 cents.

**Engineering Standards.** Report of Conference on Unification of Engineering Standards, Combined Production and Resources Board. Price 20 cents.

**Effect of Variety, Location, and Season on Oil, Protein, and Fuzz of Cottonseed and on Fiber Properties of Lint.** By O. A. Pope and J. O. Ware. Department of Agriculture Technical Bulletin 903. Price 10 cents.

**Bibliography on Construction, Design, Economics, Performance, and Theory of Portable and Small Stationery Gas Producers.** By Janina Nowakowska and Richard Wiebe. Northern Regional Research Laboratory, Peoria, Illinois. AIC-103. Mimeographed.

**Production, Concentration, Properties, and Assay of the Antibiotic, Subtilin.** Western Regional Research Laboratory, Albany, California. AIC-106. Mimeographed.

**World Trends in Major Oil Crops.** By Peter L. Hansen. Bureau of Agricultural Economics. FM 54. Processed.

# MANUFACTURERS' LATEST PUBLICATIONS

*Chem. & Met.'s Readers' Service, in cooperation with manufacturers, makes it possible for you to secure catalogs, bulletins, and other publications herein listed without cost or obligation (unless a price is specifically mentioned). Please check the items you wish to receive and fill out the coupon below. Then send to Readers' Service, Chem. & Met., 330 W. 42nd St., New York 10, N. Y.*

**1**

**Adhesives.** Paisley Products, Inc., Chicago, Ill.—8-page illustrated folder cataloging the various types of adhesive products made by this company and the services available to adhesive users.

**2**

**Alloys.** Ampco Metal, Inc., Milwaukee, Wis.—Bulletin 69. 8-page bulletin illustrating and describing the continuous cast bronze rod and tubing available from this company. A method of manufacturing by the continuous cast process is described and the advantages of continuous casting over other methods are shown. Specifications and properties are given. Bulletin 80. 4-page leaflet featuring Ampco metal bushings. Includes price list of standard sizes. Also bulletin No. 140 and 141 featuring the uses of this company's alloys in large industrial presses.

**3**

**Aluminum Alloys.** Aluminum Alloys Corp., Detroit, Mich.—10-page illustrated catalog describing this company's complete facilities for production of aluminum alloy castings. Contains tables on the chemical and physical properties of aluminum alloys plus a section on the general characteristics and uses of aluminum.

**4**

**Barometric Condensers.** Schutte & Koerting Co., Philadelphia, Pa.—Bulletin 5-AA. 20-page bulletin illustrating and describing the four types of barometric condensers manufactured by this company. Multi-colored sketches are used to illustrate the operation of these condensers. Sizes, capacities, specifications and applications are discussed and some typical installations are illustrated.

**5**

**Bearings.** Split Ball Bearing Corp., Lebanon, N. H.—Catalog No. 84. 30-page catalog giving specifications on sizes, load-ratings, etc. for the complete line of divisible race, ball, roller and thrust bearings manufactured by this company. Various applications are illustrated.

**6**

**Belting.** Hewitt Div., of Hewitt-Robins, Inc., Buffalo, N. Y.—Loose-leaf illustrated booklet featuring this company's line of conveyor, transmission, and elevator belting.

**7**

**Boilers.** John Phillips Badenhausen, Inc., Philadelphia, Pa.—Bulletin 110. 4-page illustrated leaflet featuring this company's steam boilers.

**8**

**Boiler Equipment.** Strong, Carlisle & Hammond Co., Cleveland, Ohio—Catalog 102. 4-page booklet illustrating and describing the continuous blow-down valves and blow-down assemblies manufactured by this company. Includes also a supplement to this catalog describing the operation of this system.

**9**

**Bushings.** Bushings, Inc., Royal Oak, Mich.—8-page bulletin illustrating and describing the Vibro-Levelers for use in mounting machinery and equipment. Sizes, capacities, and prices are given.

**10**

**Castings.** Lebanon Steel Foundry, Lebanon, Pa.—2-page leaflet featuring the Circle L9 steel castings available from this company.

**11**

**Centrifuges.** Bird Machine Co., South Walpole, Mass.—6-page leaflet illustrating and describing the centrifugals built by this company. Cross-sectional diagram shows the various parts as well as the features of construction.

**12**

**Centrifuges.** Centrifuge Mechanical Equipment Inc., Hoboken, N. J.—2-page leaflet describing and illustrating the CME continuous centrifuge for separation of liquids from solids in various operations of dewatering, classifying, fractionating, degritting, thickening, and extracting. Also shows this company's CME continuous demulsifier for breaking emulsions.

**13**

**Chemicals.** Armour & Co., Chemical Div., Chicago, Ill.—3 technical booklets describing the Armeens (aliphatic amines), the Armids (ali-

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phatic amides), and the Arneels (aliphatic nitriles). Composition, constants, chemical properties and typical uses of these organic chemicals are listed.

**14**

**Chemicals.** A. R. Maas Chemical Co., Dept. H, 4570 Ardine St., South Gate, Calif.—A catalog containing technical information on phosphates and photographic chemicals manufactured by this company, with a description of the firm's research laboratory facilities. Includes reference tables.

**15**

**Chlorination.** Pennsylvania Salt Mfg. Co., Philadelphia, Pa.—50-page instruction booklet on the use of Perchloron in swimming pool sanitation, water purification, sewage disposal and as a bactericide in the food industry. Also a 6-page leaflet featuring the use of Perchloron as a bleach for use by laundries.

**16**

**Cleaning Compounds.** Northwest Chemical Co., Detroit, Mich.—24-page catalog featuring the cleaning and drawing compounds available from this company. Five general classifications of cleaners are covered, namely: electrolytic, immersion, solvents, spray and water wash compounds for spray booths. The Lo-Hi pH process of cleaning metal preparatory to enameling or plating is discussed.

**17**

**Compressors.** Clark Bros. Co., Inc., Olean, N. Y.—8-page leaflet entitled "Natural Gas and Natural Gasoline." Features the use of this company's compressors.

**18**

**Computer.** Consolidated Engineering Corp., Pasadena 4, Calif.—4-page folder illustrating and describing the Consolidated 12 Equation Electrical Computer. Applications, specifications, operating principles, etc., are discussed.

**19**

**Condenser Equipment.** Condenser Service & Engineering Co., Inc., Hoboken, N. J.—8-page illustrated booklet describing Flowrites, metal inserts for inlet ends of condenser tubes. These are used to prevent tube end erosion. Booklet contains report of tests, with tables, graphs and data showing the use of Flowrites in condenser operation.

**20**

**Consulting Service.** W. H. & L. D. Betz, Philadelphia, Pa.—Booklet describes the facilities and services available from this company's consulting division in water, waste and sewage plant work. Contains flow diagrams of plants for softening water for industrial use, for waste treatment, for sewage disposal and for pretreatment of water for boiler purposes and other industrial uses.

**21**

**Conveyors.** Process Engineers, Pittsburgh, Pa.—2-page leaflet featuring the Convair pneumatic conveying system manufactured by this company.

**22**

**Corrosion.** United States Steel Corp., Chicago, Ill.—16-page booklet entitled "Corrosion of Steels." Corrosion resistant alloys are discussed as are corrosion resistant coatings for steels.

**23**

**Cosmetic Chemicals.** Givaudan - Delawanna, Inc., New York, N. Y.—10-page booklet describing sunscreening agents, with charts for various tanning and sunburning rays. Includes formulas to meet the requirements of suitable suntan preparations.

**24**

**Couplings.** John Waldron Corp., New Brunswick, N. J.—Catalog No. 57. 20-page booklet illustrating and describing the Series A flexible couplings manufactured by this company. Includes tables of ratings for the various size couplings for different types of service.

**25**

**Crushers.** Traylor Engineering & Mfg. Co., Allentown, Pa.—Bulletin 4112. 22-page bulletin illustrating and describing the Type TY reduction crusher manufactured by this company. General specifications are given and a detailed parts list together with drawings are included. Contains complete instructions for the assembly, erection, lubrication, operation and repair of this crusher. Bulletin 4637. 38-page booklet featuring this company's crushing rolls. Sizes and specifications of the various types of crushing rolls are included and other pertinent information is given. Bulletin 2105. 14-page bulletin illustrating and describing the type H Blake jaw crusher. The improvements made in this equipment are covered in an addendum to this bulletin, which was published in 1941.

**26**

**Dryers.** H. K. Porter Co., Inc., Pittsburgh, Pa.—16-page booklet featuring the Devine vacuum-chamber dryers manufactured by this company. Construction details are illustrated and specifica-

tions for the various types and sizes are given. Includes data on hot water circulating systems, unit surface condensers, reciprocating vacuum pumps and jacketed pump fittings made by this company. Several engineering tables and curves are given throughout the book.

**27**

**Dust Collectors.** Aget-Detroit Co., Ann Arbor, Mich.—Catalog A-350. 8-page booklet illustrating and describing the Dustkop dust collectors made by this company.

**28**

**Dust Collectors.** American Air Filter Co., Inc., Louisville 8, Ky.—Bulletin No. 270-A. 34-page booklet illustrating and describing this company's Roto-clone dust control equipment. Contains many installation photographs, tables, charts, and a discussion of a simplified procedure for designing a Roto-clone exhaust system. Included also is an explanation of pressure relationships in an exhaust system together with methods of measurement.

**29**

**Dust Collectors.** American Foundry Equipment Co., Mishawaka, Ind.—2-page leaflet featuring this company's Dustube dust collectors.

**30**

**Dust Collectors.** Ideal Industries, Inc., Sycamore, Ill.—4-page leaflet illustrating and describing the Ideal dust collector for use on grinders, buffers, sanders, and other similar equipment.

**31**

**Excavator.** Trackson Co., Milwaukee, Wis.—4-page leaflet featuring the Model IT4 Traxcavator used in excavation work. The advantages of this equipment are given, along with specifications.

**32**

**Ejectors.** Elliott Co., Jeanette, Pa.—Bulletin D-9. 4-page illustrated bulletin describing this company's type G impervious graphite ejectors for handling extremely corrosive vapors. Cross sectional views show the construction details of this ejector which is machined from a special high density graphite.

**33**

**Electric Motors.** Crocker-Wheeler Div., Joshua-Hendy Iron Works, Ampere, N. J.—4-page illustrated leaflet featuring the Crocker-Wheeler protected type motors manufactured by this company. Illustrates and describes the important features of this motor.

**34**

**Electrical Switches.** General Control Co., Boston, Mass.—Catalog No. 100. 8-page booklet illustrating and describing the manually-operated foot switches manufactured by this company. Specifications are included.

**35**

**Electric Tools.** Syntron Co., Homer City, Pa.—Catalog 464. 40-page pocket size booklet illustrating and describing this company's complete line of electric tool equipment which includes portable electric hammers, drills, screw drivers, etc.

**36**

**Emulsion.** Atlas Powder Co., Industrial Chemicals Dept., Wilmington 99, Del.—55-page booklet entitled "Drug and Cosmetic Emulsions." Contains information on surface activity and surface active agents, emulsion formulation and manufacture, oil and water cosmetic formulation, water and oil cosmetic formulation, medicated ointment formulation, and specialties formulation. A final chapter lists all of the Atlas products used in drug and cosmetic formulation. Price, $1 per copy.

**37**

**Engineering Service.** Southwestern Engineering Co., Los Angeles, Calif.—8-page booklet describing the services available from this company in designing and constructing industrial plants.

**38**

**Equipment.** American Machine & Foundry Co., New York, N. Y.—28-page reprint of an address given by Dr. Roland P. Soule entitled "The Problem Children of Technology and Banking."

**39**

**Equipment.** Elliott Co., Jeannette, Pa.—Bulletin Q-12. 20-page booklet featuring this company's equipment for power plants and industrial processes. Includes information on equipment such as steam turbines, turbine generators, mechanical drive turbines, motors and generators, feed water heaters and deaerators, condensers and auxiliaries, steam jet ejectors, centrifugal blowers, and other accessories and equipment.

**40**

**Equipment.** Fansteel Metallurgical Corp., North Chicago, Ill.—4-page booklet entitled "A Production Plant in Miniature." This booklet

features the pilot plant equipment made by this company.

**41**

**Evaporators.** The Griscom-Russell Co., New York, N. Y.—Bulletin 364. 26-page bulletin illustrating and describing the various types of G-R Ventube evaporators for various capacities and pressures. Contains several sections of special interest to plant engineers and executives including an explanation of the functions of evaporators, benefits obtained by their use, etc. Contains photographs and diagrams of various types of evaporators including details of design. Contains heat flow diagrams of plants equipped with evaporator systems.

**42**

**Filters.** General American Process Equipment, Div. of General American Transportation Corp., New York, N. Y.—Bulletin 102. 4-page booklet illustrating and describing the Conkey rotary disc vacuum filter manufactured by this company. Contains diagrammatic sketches showing the principles of operation. Includes data on applications, and includes a table of sizes and dimensions of the various filters available.

**43**

**Fire Protection Equipment.** Grinnell Co., Inc., Providence, R. I.—12-page booklet illustrating and describing the spray nozzles for use in extinguishing oil and flammable liquid fires with water.

**44**

**Flexible Couplings.** Thomas Flexible Coupling Co., Warren, Pa.—Pocket size folder illustrating the various flexible couplings manufactured by this company.

**45**

**Flexible Hose.** Pennsylvania Flexible Metallic Tubing Co., Philadelphia, Pa.—Export bulletin printed in English, French, Spanish and Portugese, which illustrates and describes the complete line of flexible metallic hose and couplings manufactured by this company.

**46**

**Flooring.** Walter Maguire Co., Inc., New York, N. Y.—Bulletin 601. Illustrated bulletin describing a heavy duty non-skid, non-absorbent and acid resistant industrial flooring available from this company.

**47**

**Heat Exchangers.** H. K. Porter & Co., Inc., Pittsburgh, Pa.—18-page booklet featuring the Devine heat exchangers made by this company. Includes diagrammatic sketches showing the principle of operation of this equipment, also sketches of the various types of heat exchangers available. Also contains a 2-page section on explanation of terms used in heat exchange work and several pages are devoted to the fundamentals of heat exchanger design.

**48**

**Hydrocarbon Thermodynamics.** Foster-Wheeler Corp., New York, N. Y.—19-page reprint entitled Hydrocarbon Thermodynamics summarizes the fundamental concepts of thermodynamics and reviews some of the important contributions made in the application of thermodynamics to hydrocarbon problems.

**49**

**Industrial Locomotives.** H. K. Porter Co., Inc., Pittsburgh, Pa.—44-page booklet featuring the diesel electric locomotives made by this company. Many of the important features of these locomotives are illustrated and described.

**50**

**Injection Molding.** The Hydraulic Press Mfg. Co., Mt. Gilead, Ohio—Bulletin 4601. 6-page illustrated booklet describing the features of the Turbojector for injection molding of rubber.

**51**

**Instruments.** Bailey Meter Co., Cleveland, Ohio—Bulletin 232. 16-page booklet featuring the Pyrotron electronic potentiometer pyrometer manufactured by this company. Includes details of construction, specifications, and gives features of this instrument and its accessories.

**52**

**Instruments.** The Bristol Co., Waterbury, Conn.—2-page leaflet describing typical applications of Bristol continuous pH control in paper mills.

**53**

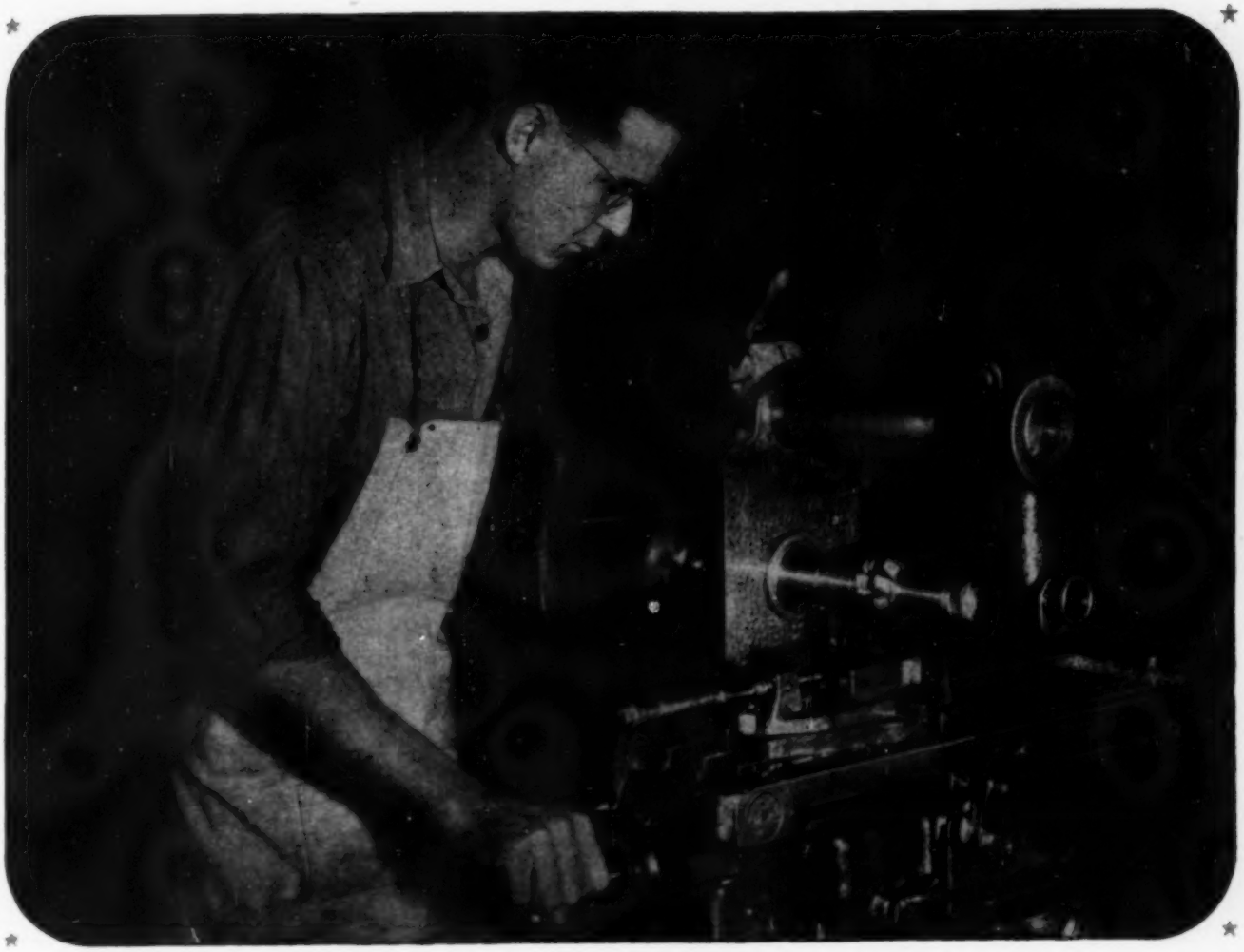
**Instruments.** Cambridge Instrument Co., Inc., New York, N. Y.—Bulletin No. 194-SA. 12-page bulletin illustrating and describing the portable surface pyrometers manufactured by this company. Applications are listed and illustrated.

**54**

**Instruments.** The Faxfilm Co., Cleveland, Ohio—10-page leaflet featuring the Faxfilm comparator together with its use and application. It is used for setting up inspection and roughness standards, and other similar applications.

**55**

**Instruments.** Fischer and Porter Co., Hatboro,



# *Check these Main Points*

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Contains a wealth of reliable, certified data, not only on the machining of Allegheny Metal, but on the best methods employed in other fabrication operations on stainless steel—forming, welding, finishing, etc. Write for your copy—you'll find it highly useful and complete.

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More important, check the design of the cutting tool itself, and check the possibility of using one of the special easy-machining grades of Allegheny Metal. Let us help you also to select the right cutting tool from our complete range of High Speed Steels, ALX Cast Alloy Bits and Carmet Carbide Tools.

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Pa.—Catalog Section 52-A. 4-page catalog featuring the Rota-tronic for use with rotometers to indicate, record, totalize and control. Schematic wiring diagram is included, and the method of operation is described.

**56**

**Instruments.** Emil Greiner Co., New York, N. Y.—8-page pocket size leaflet describing the McLeod gages made by this company. Contains instructions for use.

**57**

**Instruments.** Gotham Instrument Co., New York, N. Y.—Catalog C-51. 18-page booklet illustrating and describing this company's line of etched stem thermometers and hydrometers.

**58**

**Instruments.** Industrial Instrument, Inc., Jersey City, N. J.—Catalog describing the conductivity cells for plant and laboratory use in checking conductivity of various liquids.

**59**

**Instruments.** Leeds & Northrup Co., Philadelphia, Pa.—Catalog ED. 38-page catalog featuring the galvanometers and dynamometers manufactured by this company. Includes complete specifications and prices for DC and AC galvanometers, both reflecting and pointed types, as well as the Astatic dynamometers. Various other parts and accessories are listed.

**60**

**Instruments.** Northern Equipment Co., Erie, Pa.—Bulletin 449. 4-page leaflet featuring the control of feed flow and water level with the Copes Flowmatic regulator. Bulletin 451. 8-page booklet describing Copes equipment.

**61**

**Instruments.** Photovolt Corp., New York, N. Y.—15-page bulletin illustrating and describing the Lumetron photoelectric colorimeter model 450 for Nessler tubes.

**62**

**Instruments.** United Electric Controls Co., Boston, Mass.—Catalog giving information and engineering details on the complete line of thermostats and pressure switches manufactured by this company.

**63**

**Instruments.** Weston Electrical Instrument Corp., Newark, N. J.—New house-organ entitled Weston Engineering Notes which provides pertinent application engineering information for users of electrical indicating instruments. The first issue of this publication appeared in February, 1946.

**64**

**Instruments.** Wheelco Instruments Co., Chicago, Ill.—Bulletin D4-2. 4-page booklet illustrates and describes the Multronic Capacitrol, a multiposition electronic pyrometer controller. Lists applications and features of the new instrument and includes application diagrams.

**65**

**Laboratory Service.** Truesdail Laboratories, Inc., Los Angeles, Calif.—20-page brochure entitled "More Profits with Chemistry." This booklet features the services available from this company.

**66**

**Materials Handling.** Automatic Transportation Co., Chicago, Ill.—Two bulletins now available from this company describe the Transtractor, a push-pull type unit combining the features of the electrically propelled hand truck and the conventional warehouse tractor. The second bulletin describes the automatic selenium battery charger for recharging this company's electric trucks.

**67**

**Materials Handling.** Lamson Corp., Syracuse, N. Y.—20-page booklet illustrating and describing the overhead chain conveyors for use in manufacturing operations, in traveling stockroom procedures, in stockrooms and warehouses, and in packing and shipping departments. Typical layouts are shown and a number of industrial applications are illustrated.

**68**

**Materials Handling.** Revolvator Co., North Bergen, N. J.—Bulletin 95K2 describes the Red Giant Model G Liftruck. Sizes, dimensions, and operating features are given. Bulletin 96-J illustrates and describes this company's hydraulic elevators. Bulletin No. 142 shows the carboy dispensers and barrel dumpers made by this company.

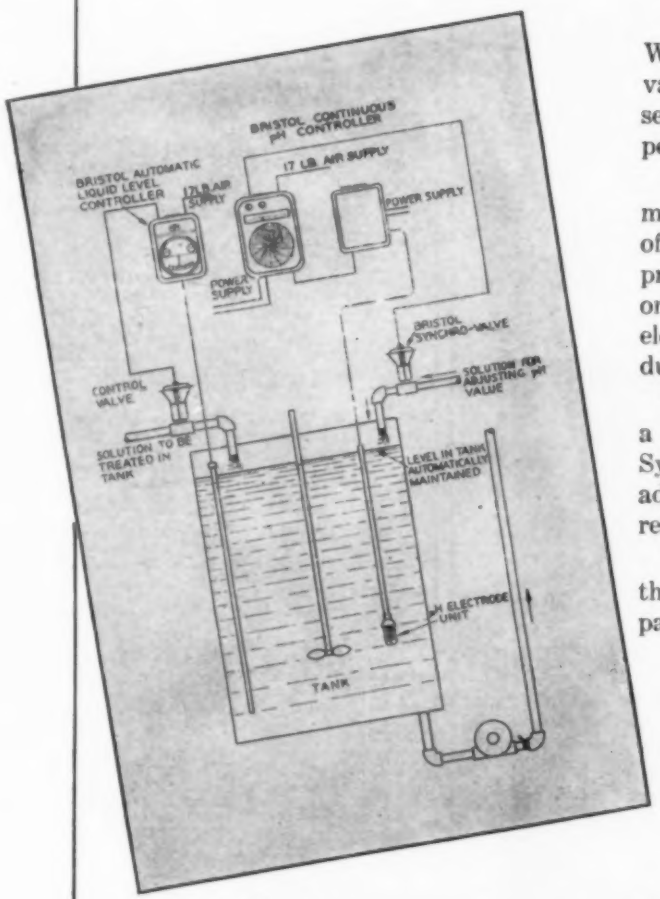
**69**

**Microchemistry.** Foster D. Snell, Inc., Brooklyn, N. Y.—8-page booklet describing the microchemical services available from this company.

**70**

**Milling Equipment.** Allis-Chalmers Mfg. Co., Milwaukee, Wis.—Bulletin No. B-6194-A. Bulle-

# How to keep pH continuously OK




When you know pH is always right, regardless of variables affecting process liquid, you save yourself worry and can safely eliminate constant or periodic attention.

In the Bristol method of controlling pH automatically, the liquid is examined by an electrode of either enclosed-flow type (for liquids under pressure) or immersion type (for liquids in tanks or vats). A temperature bulb mounted in the electrode assembly compensates for variations due to temperature changes of the solution.

The pH value is reported to the pH controller — a Bristol Pyromaster which operates a Bristol Synchro-valve — to vary input of the solution for adjusting pH value. Meanwhile, the value is recorded continuously on the round chart.

Bulletin pH 1302 gives further information on the complete system. Address The Bristol Company, 109 Bristol Road, Waterbury 91, Conn.

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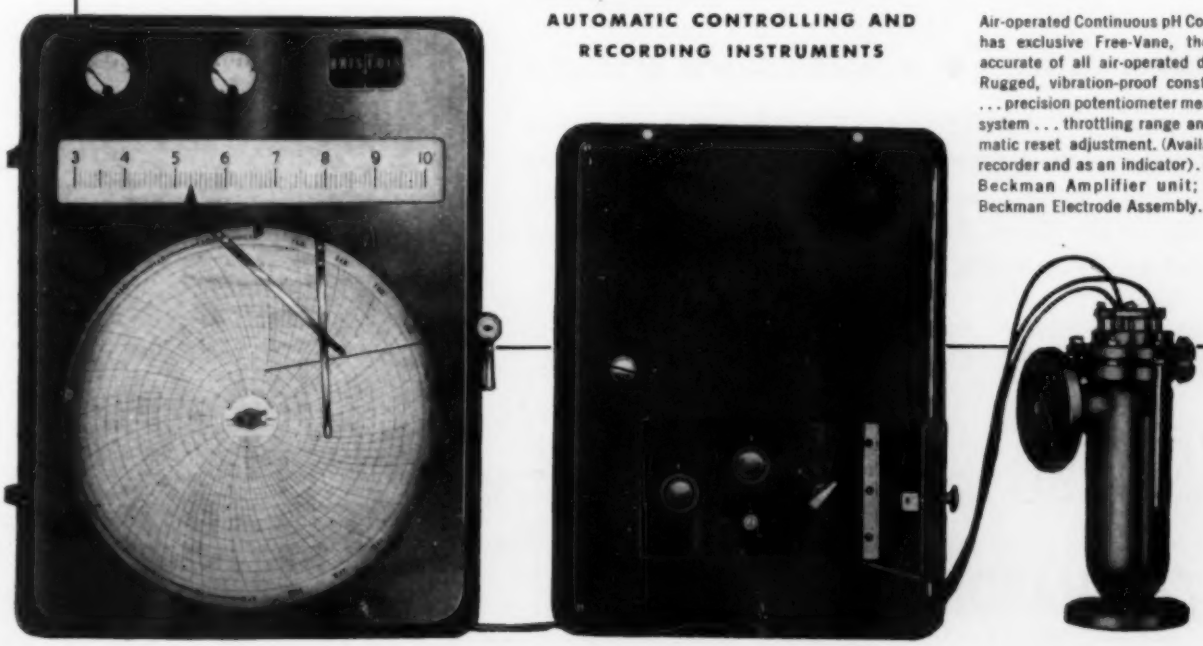


Air-operated Continuous pH Controller has exclusive Free-Vane, the most accurate of all air-operated designs. Rugged, vibration-proof construction . . . precision potentiometer measuring system . . . throttling range and automatic reset adjustment. (Available as recorder and as an indicator). Center: Beckman Amplifier unit; right: Beckman Electrode Assembly.

tin, which describes the features and applications of milling equipment manufactured by this company.

**71**

**Motor Starters.** Allis-Chalmers Mfg. Co., Milwaukee, Wis.—Bulletin 14-B6410. New bulletin describes this company's Type H line of motor starters. The features of this motor starter together with other pertinent information are discussed.

**72**

**Mycalex.** General Electric Co., Chemical Dept., Pittsfield, Mass.—24-page booklet featuring G-E Mycalex, a stonelike product composed of mica and glass. Contains a table of properties together with information on types available, molded parts, fabricated parts, machining practice and how and where to order this material.

**73**

**Nickel Alloys.** International Nickel Co., Inc., New York, N. Y.—44-page pocket size booklet entitled "How to Find Long Life in Parts and Accessory Equipment." It describes 188 separate nickel alloy items listing the name and address of each manufacturer.

**74**

**Oil Separators.** Gale Oil Separator Co., Inc., New York, N. Y.—4-page leaflet entitled Conserve the Life Blood of Industry. Contains information on the oil separator which makes possible the reuse of water, oil and other liquids at low cost. The advantages of Gale oil separators are listed and the equipment illustrated.

**75**

**Packaging.** Bemis Bros. Bag Co., St. Louis, Mo.—12-page booklet entitled "Seven Facts about Low Cost Protective Packaging." This booklet features the use of waterproof paper-lined textile bags manufactured by this company.

**76**

**Paper Chemicals.** Hercules Powder Co., Wilmington, Del.—4-page leaflet featuring this company's chemicals for the paper industry.

**77**

**Physics Research.** Philips Laboratories, Inc., New York, N. Y.—A new house organ entitled "Philips Research Report" is now being published by this company for the purpose of presenting the results of its research work. It will be published bi-monthly and will cover theoretical and experimental research, physics, chemistry, and other fields. It is edited by the research laboratory staff of this company.

**78**

**Pipe Hangers.** Grinnell Co., Inc., Providence, R. I.—8-page booklet illustrating and describing the Grinnell pre-engineered sway brace. Details of construction are shown and installation procedure is described.

**79**

**Plastics.** Celanese Plastics Corp., New York, N. Y.—Illustrated booklet showing the principal types of Celanese plastics, how these products are processed, ASTM testing methods, and other useful information.

**80**

**Plastics.** General Electric Co., Pittsfield, Mass.—12-page booklet entitled "Plastics for Light Conditioning." Illustrates the use of plastics for light reflectors.

**81**

**Pneumatic Equipment.** National Pneumatic Co., New York, N. Y.—Bulletin EC-102. 6-page folder illustrating and describing pneumatic equipment for operating sliding doors. Installation sketches are shown. Includes information on the adjustment and control of this equipment.

**82**

**Portable Lighting Equipment.** American Gas Accumulator Co., Elizabeth, N. J.—8-page booklet illustrating the portable lighting equipment and accessories available from this company. Contains a section on the facilities and services offered.

**83**

**Precious Metals.** The American Platinum Works, Newark, N. J.—4-page leaflet entitled Platinum, Gold and Silver for Science, Industry and the Arts. Discusses the increasing value of these metals to modern industry.

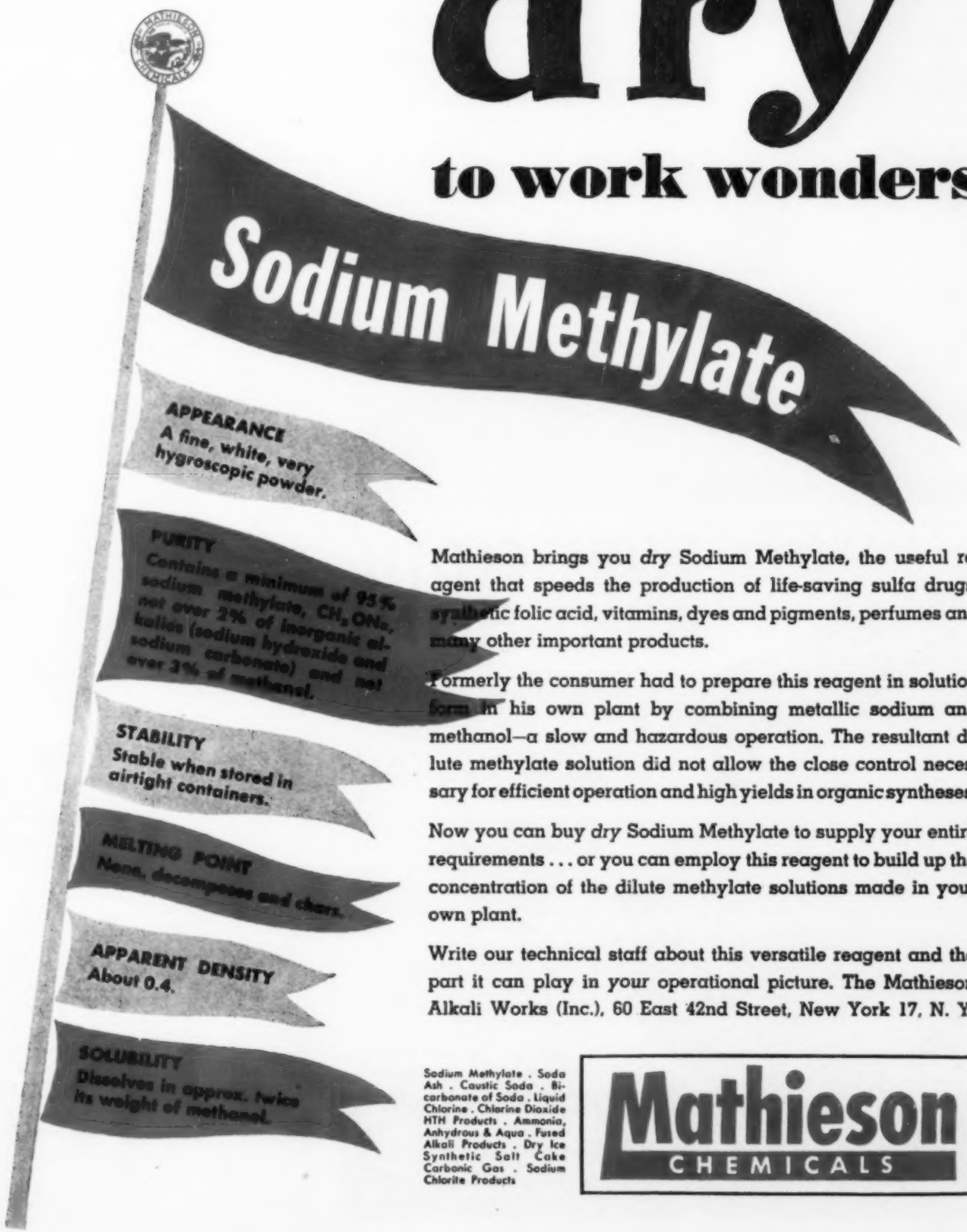
**84**

**Process Equipment.** Marco Co., Inc., Wilmington, Del.—20-page illustrated booklet illustrating and describing the Flow-Master line of equipment maunfactured by this company. Includes data on pumps and homogenizers used in a wide variety of industries.

**85**

**Process Equipment.** Chain Belt Co., Milwaukee, Wis.—Bulletin 46-3. 44-page booklet featuring the complete line of Rex sanitation and liquid clarification equipment available from this com-

# it's made dry to work wonders

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Formerly the consumer had to prepare this reagent in solution form in his own plant by combining metallic sodium and methanol—a slow and hazardous operation. The resultant dilute methylate solution did not allow the close control necessary for efficient operation and high yields in organic syntheses.

Now you can buy *dry* Sodium Methylate to supply your entire requirements . . . or you can employ this reagent to build up the concentration of the dilute methylate solutions made in your own plant.

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**Mathieson**
CHEMICALS

pany. Includes data on conveyor sludge collectors, sludge removers, grit collectors and washers, thickeners, skimmers, filters, etc. The various types of equipment are illustrated with diagrammatic sketches and several flow diagrams show different applications.

**86**

**Process Heating.** Blaw-Knox Co., Pittsburgh, Pa.—12-page booklet featuring this company's Supertherm heating systems for use in the process industries. Include a discussion on the use of superheated water for process heating.

**87**

**Protective Coatings.** The Dampney Co. of America, Doylestown, Pa.—4-page leaflet describing how to protect metal surfaces in power and process equipment against temperature damage with Thur-Ma-Lox high heat-resistance coating.

**88**

**Protecting Film.** Better Finishes and Coatings, Inc., Newark, N. J.—10-page illustrated brochure featuring the present and potential applications of this company's liquid envelope, a plastic protecting film.

**89**

**Proportioning Pumps.** Lapp Insulator Co., Inc., Le Roy, N. Y.—Bulletin 242. 4-page illustrated booklet describing the Wilson Pulsafeeder proportioning pump manufactured by this company. Principles of construction and operation are given, and various applications are illustrated with diagrammatic sketches. The different types of pulsafeeders are shown, together with a table of sizes, capacities, and shipping weights.

**90**

**Protective Clothing.** B. F. Goodrich Co., Akron, Ohio.—Catalog section 12000. 10-page catalog section on the complete line of industrial protective clothing for use in various industries. Includes several additions to this line of equipment made from new and improved plastic materials and synthetic rubber.

**91**

**Pulp and Paper Machinery.** Improved Paper Machinery Corp., Nashua, N. H.—16-page booklet describing the equipment used in the manufacture of pulp and paper. The booklet is well-illustrated with application layouts for various processes including bleaching. Manufacture of groundwood, sulphite, soda and sulphate pulp and for various other applications.

**92**

**Pumps.** Economy Pumps, Inc., Hamilton, Ohio —Catalog No. G-845. 16-page illustrated booklet describes this company's axial flow pumps for capacities up to 100,000 gal. per min., and for heads to 50 ft. Constructional details are shown by cross-sectional diagrams. Various applications are illustrated. Contains selection tables for axial flow pumps, as well as a section on typical special pump arrangement and installations.

**93**

**Pumps.** Marco Co., Wilmington, Del.—14-page booklet illustrating and describing the Flow-Master pumps manufactured by this company. Important features are liated, and dimensions and capacities are given for the various types of pumps offered.

**94**

**Pumps.** H. K. Porter Co., Inc., Pittsburgh, Pa.—12-page booklet featuring the Rotex pumps for moderate viscosity, low viscosity and medium pressure. Features of these pumps are shown and diagrammatic sketches show construction details. Specifications are included. Also 8-page leaflet featuring the Quimby Type CF and DS contrifugal pumps. Construction details and dimensions are given by cross sectional sketches and tables. Includes selection chart.

**95**

**Pumps.** Taber Pump Co., Buffalo, N. Y.—8-page booklet entitled "Inference Is a Dangerous Guide to Pump Selection." Various types of pumps manufactured by this company are illustrated and described. A discussion is presented on pump selection together with the various pumping problems and how they can be solved by use of the proper pumps.

**96**

**Pumps.** Worthington Pump & Machinery Corp., Harrison, N. J.—Bulletin W-350-B8. 16-page booklet featuring Worthite pumps for slurry handling. Various processes in which these pumps are used are discussed. Industries served by these pumps include byproduct coke, coal tar products, clay, glass, metal refining, petroleum refining, pulp and paper, sugar, and many others. Bulletin W-414-B50. 8-page folder featuring this company's Varifio triplex power pump. Details of construction are illustrated in multi-color drawings. Contains tables of sizes and ratings of the various size pumps. A list of some of the services for this pump is included.

**97**

**Refractory Concrete.** The Atlas Lumnite Cement Co., New York, N. Y.—24-page booklet

containing basic information on materials and methods used in making refractory concrete for different temperature and insulating requirements. Illustrations show a wide range of applications of refractory concrete in construction of heat-treating furnaces, cooling pits, coke ovens and ceramic kilns.

**98**

**Refrigeration.** Worthington Pump & Machinery Corp., Harrison, N. J.—2-page leaflet featuring this company's compressors for use on refrigeration systems.

**99**

**Rubber Products.** Naugatuck Chemical Div. of United States Rubber Co., New York, N. Y.—2-page leaflet featuring Aminox anti-oxidant. Prices are included. Also 4-page bulletin describing the applications and use of Lotol, a compounded latex used in adhesives, coatings, binders, and other similar applications. Bulletin L.

**100**

**Rubber Products.** B. F. Goodrich Co., Akron, Ohio—New booklet entitled "Suspended on Rubber." Illustrates and describes the Torsilastic rubber spring and its commercial and industrial applications. Includes an 8-page section on the technical development of this type of spring. Also 18-page booklet illustrating and describing the properties and uses of Koroseal and Koroseal compounds.

**101**

**Safety Equipment.** Davis Emergency Equipment Co., Inc., Newark, N. J.—94-page catalog illustrating and describing the complete line of protection equipment for first-aid, respiratory protection, and general safety equipment for personal protection. Includes information on combustible gas indicators and other Davis instruments, together with electrical safety equipment. A 4-page alphabetical index makes it easy to find items of interest.

**102**

**Safety Equipment.** Eastern Equipment Co., Willow Grove, Pa.—Catalog section No. AWP-21. 4-page leaflet featuring Amcoweld lenses for goggles, helmets and hand shields used in welding operations.

**103**

**Seat Grinders.** Elliott Co., Jeannette, Pa.—Bulletin Y-22. 4-page bulletin illustrating and describing this company's handhole seat grinder for use in grinding handhole seats in boilers and superheaters.

**104**

**Separation Processes.** American Cyanamid Co., New York, N. Y.—4-page leaflet featuring this company's heavy-media separation processes, flotation machines and separation reagents.

**105**

**Sewage Treatment.** Filtros, Inc., E. Rochester, N. Y.—30-page engineering bulletin entitled "Aeration Tanks and Diffuser Media in the Activated Sludge Process of Sewage Treatment." Information on the fundamental principles of this process, including various cross-sectional diagrams of the equipment used. Contains information on diffuser media and also a section on cleaning diffuser plates.

**106**

**Silicones.** Dow Corning Corp., Midland, Mich.—Bulletin No. 1A. 4-page leaflet featuring the properties and uses of Silastic, a Silicone rubber. Contains a table showing the chemical resistance of this material to various corrosive fluids.

**107**

**Spray Painting.** J. O. Ross Engineering Corp., New York, N. Y.—2-page leaflet illustrating the paint finishing system available from this company. Includes spray booths, ovens, etc.

**108**

**Stainless Equipment.** Allegheny Ludlum Steel Corp., Brackenridge, Pa.—36-page illustrated booklet entitled "Allegheny Metal in the Dairy Industry."

**109**

**Stainless Steel Bellows.** Chicago Metal Hose Corp., Maywood, Ill.—12-page booklet entitled CMH stainless steel bellows which illustrates and describes this product. Information is given on the use of stainless steel bellows as equalizers, compensators for expansion joints, flexible connectors, for flow control and vapor and steam traps, thermostatic instruments, electrical controls and other industrial applications.

**110**

**Tachometers.** O. Zernickow Co., New York, N. Y.—2-page leaflet illustrating and describing this company's line of hand tachometers.

**111**

**Textile Chemicals.** Dexter Chemical Corp., New York, N. Y.—Booklet entitled "A Study of the Mercerization Process" which contains three

parts covering: Effect of the mercerizing caustic soda concentrations; the effect of tension; the effect of caustic temperature.

### 112

**Textile Resins.** American Cyanamid Co., Textile Resins Dept., Bound Brook, N. J.—Bulletin No. 113 entitled "Resins for Textiles" describes the uses and applications to textiles of thermosetting and thermoplastic resins.

### 113

**Tube Cleaners.** Elliott Co., Jeannette, Pa.—Bulletin Y-23. 4-page leaflet featuring the Lagonda 2,000 Series tube cleaners, manufactured by this company. This water-driven type cleaner for straight and curved tubes is illustrated and described.

### 114

**Tubing.** The Carpenter Steel Co., Kenilworth, N. J.—Pocket-size slide-rule which summarizes the technical data to aid in the proper selection of the various grades of this company's stainless steel tubing.

### 115

**Tubing.** Trent Tube Mfg. Co., East Troy, Wis.—16-page booklet featuring Trentweld stainless tubes.

### 116

**Vacuum Pumps.** Schutte & Koerting Co., Philadelphia, Pa.—Bulletin 5-AA4. 4-page illustrated booklet featuring the hydro-steam vacuum unit available from this company. Detailed drawing shows the various dimensions and a table of sizes and capacities is included.

### 117

**Valves.** Alloy Steel Products Co., Linden, N. J.—Bulletin No. 2. 4-page booklet illustrating and describing this company's line of valves made with Aloyco-20. The various types of valves are illustrated and construction details, sizes and capacities given. A list of applications for these corrosion resistant valves is included. Also a 4-page leaflet illustrating the manufacturing processes used in making these valves.

### 118

**Valves.** Edward Valves, Inc., East Chicago, Ind.—New valve booklet illustrates and describes the principal operations used in the manufacture of Edward Valves.

### 119

**Vapor Recovery.** Vapor Recovery Systems Co., Compton, Calif.—Handbook and Catalog No. P-7, 188-page engineering catalog of this firm's line of tank equipment, gas control and safety devices for handling combustible or toxic liquids and gases in industry. Indexed into sections on engineering data, venting designs, gauges, swing lines, vapor recovery regulators, angle relief valves and miscellaneous items. Includes formulas, flow capacity curves and capacity tables, conversion tables, photographs and diagrams of equipment. Gives sizes, dimensions, weights and list prices.

### 120

**Water Storage Heaters.** The Patterson-Kelley Co., Inc., East Stroudsburg, Pa.—Catalog No. 17. 20-page illustrated catalog describing the hot water storage heaters and preheaters manufactured by this company. Construction details are illustrated and tables show capacities, dimensions, and specifications for the different types and models. Hot water consumption for various types of domestic and commercial building service is tabulated.

### 121

**Welding.** American Welding Society, New York, N. Y.—47-page booklet compiling the recommended practices for resistance welding, published by the American Welding Society. Price, 50c. per copy.

### 122

**Welding.** Metal and Thermit Corp., New York, N. Y.—16-page technical bulletin covering hard surfacing and the use of Hardex Electrodes in building up surfaces for resistance to shock and abrasion. Information is given on various factors such as effective temperature and cooling rates on deposited metal, selection of the proper grade of rod, and recommended welding techniques.

### 123

**Welding Electrodes.** Hollup Corp., Chicago, Ill.—6-page Selectrode chart for guiding electrode users in the choice of the correct electrodes for specific jobs. It specifies which electrode to use, suggests applications, gives currents, physical characteristics, and other information.

### 124

**Wood Tanks.** Acme Tank Manufacturing Co., 5402 South Soto St., Los Angeles 11, Calif.—Bulletin C-45-IML. 19-page booklet giving diagrams, photographs and specifications for special types and shapes of tanks for a diversity of industrial uses.

# CHEMICAL ECONOMICS

H. M. BATTERS, Market Editor

## PRODUCTION OF CHEMICALS DROPPED IN MAY BECAUSE OF CURTAILMENT OF RAW MATERIALS

IN THE FACE of adverse conditions, production of chemicals made good progress throughout April but reports regarding activities in May are less favorable. While industry figures are not yet at hand, it is evident that the cutting down of raw material supplies forced a lowering of production schedules. The coal situation, in particular, was responsible for a good part of the slowing up. Even where stocks of coal were on hand, uncertainty about replacements made it desirable to move with caution and production was cut back in order to conserve stocks of coal and thus minimize the danger of total closing of entire units. Further complications were added by the limitations placed on transporting materials. The renewal of coal mining brought improvement but in most industries some weeks must elapse before full production can be reached.

The latest authority for measuring industry production is found in the index of the Federal Reserve Board for April and this reports a drop of three points from the March figure, the index numbers being 164 for March and a preliminary figure of 161 for April. From the partial reports already issued the decline in operations in May was more acute and more widespread. The April index of the Board for production of industrial chemicals was 397 which compares with revised figures of 389 for March and 383 for February. Thus the index continues to show a rising line for production of chemicals. Detailed figures for heavy chemicals show a mixed trend with April production of sulphuric acid registering a gain over March but a decline was noted in the case of chlorine and caustic soda with electrolytic surprisingly making a better relative showing than the lime-soda product. Production of sodium phosphates held up well in April with larger outputs for mono and tetra but a rather sharp drop was reported for tribasic.

Consumption of chemicals in May apparently followed the trend of general industry but oil refining was on a broader scale than at any time this year. The *Chem. & Met.* index for industrial consumption of chemicals moved down to 205.60 in April as compared with a revised figure of 206.27 for March. There were no radical changes in any of the consuming industries. Rayon figures for March have been revised and while shipments for that month were larger than those credited to April, they were aided by drawing from stocks. Production of yarn was almost identical in March and April but staple production moved up in April so that total rayon production for that month was slightly above the March total.

Production of vegetable oils was on a smaller scale in April although some gains were made in outputs of coconut and linseed oils. However consumption of linseed oil exceeded production and stocks in the hands of producers were further reduced. Operations at eastern crushing mills in May varied according to the amount of seed received but in general the result was far from satisfactory and there does not seem to be hope for any change in the near future. The output of coconut oil has been aided by arrivals of copra from the Philippines in larger tonnage with reports that shipments from primary points for May approximated 32,000 tons. Official announcement has been made that the Copra Export Management Co., which was established about a year ago to aid the copra industry and supervise trading will be dissolved as of June 30. This means that trading will be returned to private companies but the creation of a free market does not indicate that normal conditions have returned. Moderate increases in shipments are in prospect but it will take some time before supplies will grow up to the prewar level. Castor oil output in May was curtailed because of work stoppages at large producing plants.

While the permitted use of natural rubber was increased last March, the entire question of natural rubber supplies may be subject to revision depending on what steps are taken to replace the agreement which will expire at the end of this month. A meeting in London will determine whether Great Britain will continue to set the price or whether producers in the Far East may succeed in establishing a free market.

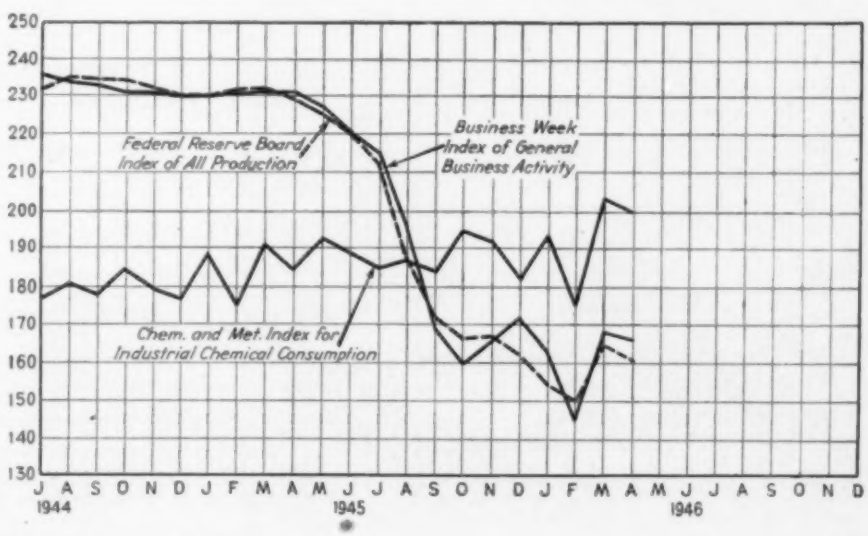
The Department of Commerce has given an encouraging report on new construction in May, placing the total of $84 million or an increase of about 15 percent over the figure for April and 109 percent above the May 1945 total. This is favorable for an expansion in demand for paints but paint manufacturers are handicapped by the shortage in many important raw materials. The scarcity in lead pigments has been pronounced for some time and the outlook was further clouded by an announcement that one producing plant at East Chicago, Ind., would complete, as far as possible, its commitments for the second quarter and then would discontinue production permanently.

Of significance to future chemical production is the progress which has been made in recent weeks in increasing total capacity by turning government plants over to private operation. The most recent announcement was that the Jayhawk Ordnance Works, near Pittsburg, Kans., has been taken over by a private company and will produce a varied line of chemicals including nitric acid, ammonia, methanol, ammonium nitrate, and carbon dioxide.

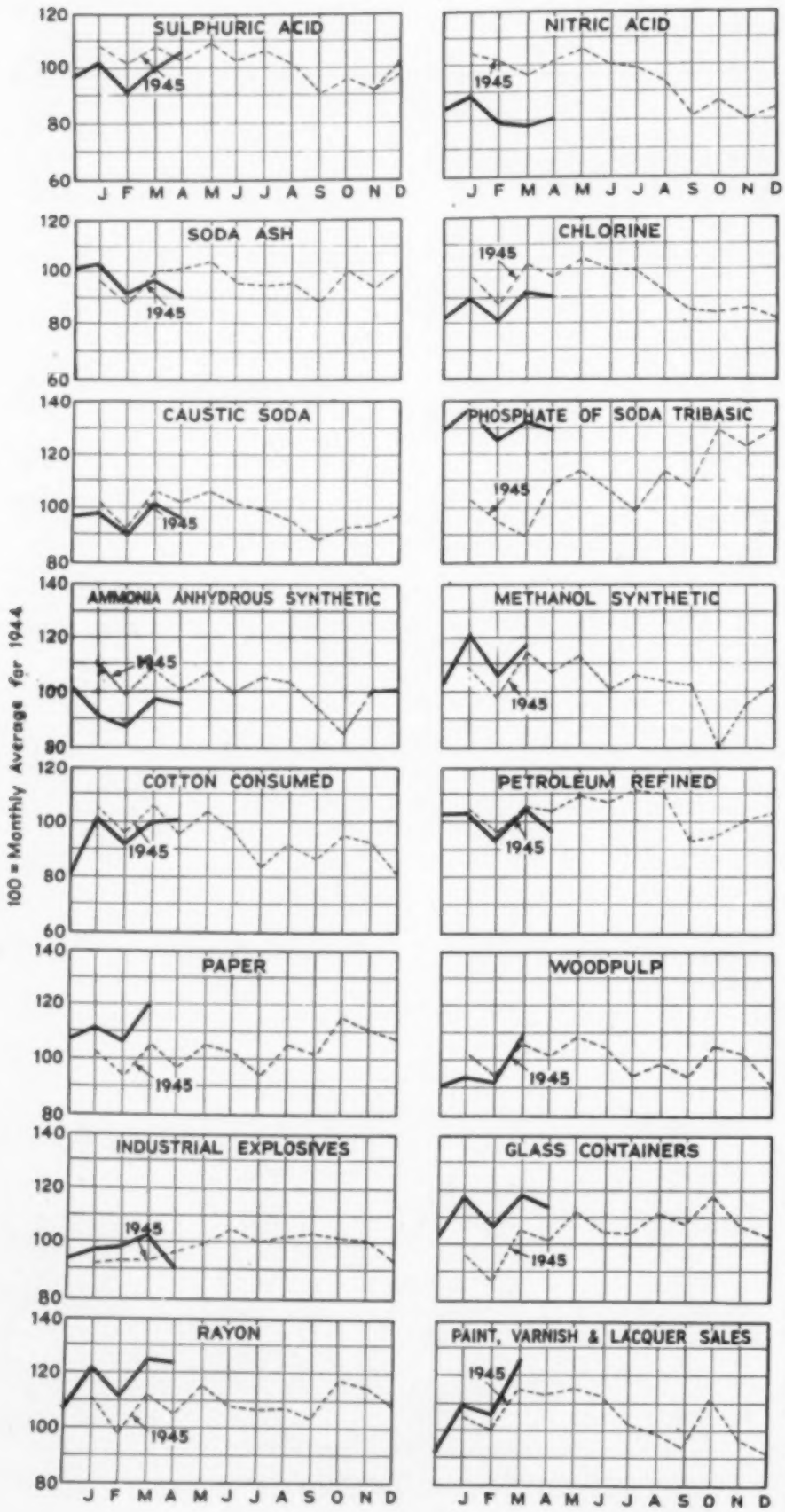
***Chem. & Met.* Index for Industrial Consumption of Chemicals**

1935 = 100

| | March Revised | April |
|---|---|---|
| Fertilizers | 44.97 | 47.67 |
| Pulp and paper | 22.49 | 22.08 |
| Petroleum refining | 18.88 | 17.66 |
| Glass | 21.90 | 21.13 |
| Paint and varnish | 21.67 | 23.49 |
| Iron and steel | 11.67 | 10.84 |
| Rayon | 20.79 | 20.81 |
| Textiles | 11.29 | 11.19 |
| Coal products | 8.98 | 8.12 |
| Leather | 4.75 | 4.60 |
| Industrial explosives | 5.58 | 4.91 |
| Rubber | 6.95 | 6.90 |
| Plastics | 6.35 | 6.20 |
| | 206.27 | 205.60 |



# PRODUCTION AND CONSUMPTION TRENDS



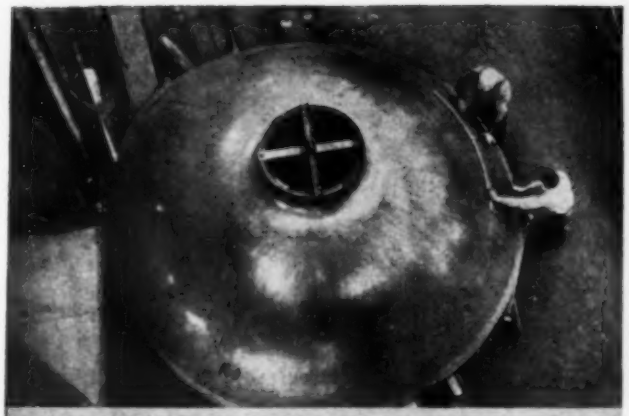

PRICES FOR chemicals throughout the war period were very firm with some upward revisions of sales schedules but with unchanged ceilings for the majority of items. The trend in recent months has been toward greater firmness and while actual changes have not been numerous this has been due to the maintenance of controls rather than the application of economic considerations. Strikes and work stoppages have increased the number of chemicals which are in small supply and have deferred the time when a balance might be expected between supply and demand.

In addition to the maladjustment between the volume of current offerings and requirements of consumers, there has been an appreciable increase in production costs as the result of higher wage scales and the marking up of prices for raw materials. In cases where higher prices for raw materials have been authorized, such as copper and lead, adjustments have been allowed on the metal salts but in other cases where chemical costs have been similarly affected, former ceilings for chemicals are maintained. It is evident, however, that prospective relaxation of controls will bring upward revisions in price schedules for some chemicals.

While the enforced drop in production rates in some consuming industries has eased the supply position of certain items, most of the larger tonnage chemicals are still scarce and some changes in distribution methods have been necessary. For instance, primary potash salts have again been placed under allocation controls in order to hold as closely as possible to the completion of the country's food program. It has been estimated that potash production will fall short by 100,000 tons of meeting full requirements and now there are fears that the shortage will reach an even higher total. Because of the shortage of lead, lead oxide for use in storage batteries has been placed under allocation and tighter controls have been decreed for its use in other industries. Although allocations for lead for ethyl fluid were raised to 4,160 tons for May as against 3,500 tons for April, the octane content of premium type gasoline has been cut in order to hold down consumption of tetraethyl lead.

Requests of producers for the establishment of higher export quotas for rosin did not meet with the approval of the Civilian Production Administration. The quotas had been established on estimates of the surplus of production over domestic consumption and on this assumption the export quota for the quarter ending June 30 was fixed at 100,000 drums with 150,000 drums as the quota for the quarter ending September 30.

Ethyl alcohol is another product over which strict controls are maintained. Production has taken a sharp drop since the end of the war with the use of grains reserved for foodstuffs and with only relatively small amounts of molasses available. This unfavorable raw material situation has affected all producers with the exception of those



Copper dome being fitted with sliding manhole cover

Rough-forming copper dome of a 16′ kettle

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*Photos courtesy of Schock, Gusmer & Co. Inc., Hoboken, N. J. fabricators and installers of brewery, distillery and similar process equipment.*

turning out the synthetic product and deliveries to consumers are supplemented by drawing upon government stocks which are steadily being reduced. Consumption of ethyl alcohol this year is limited to 150,000,000 gal. and the Cuban molasses supply has been allocated on a basis of 37,000,000 gal. for ethyl alcohol; 18,000,000 gal. for butyl alcohol; 10,000,000 gal. for feedstuffs; and 80,000,000 gal. for export or a total of 145,000,000 gal.

## END USES FOR CHEMICALS

THE Bureau of the Census has issued further reports on end uses for chemicals based on allocation records of the War Production Board. The following data are for 1944:

### Normal Butyl Alcohol

| Use | 1,000 lb. | Percent |
|---|---|---|
| Total allocations | 167,991 | 100.0 |
| Direct military[1] | — | — |
| Export | 17,560 | 10.5 |
| Other essential | 150,431 | 89.5 |
| Chemical manufacture | 96,956 | 57.7 |
| Butyl acetate | 49,373 | 29.4 |
| Dibutyl phthalate | 29,041 | 17.3 |
| Other butyl derivatives[2] | 18,542 | 11.0 |
| Lacquer solvents | 24,688 | 14.7 |
| Aircraft coatings | 12,831 | 7.7 |
| Ammunition coatings | 1,665 | 1.0 |
| Textiles and leather | 538 | 0.3 |
| Dyes and penetrants | 898 | 0.5 |
| Other protective coatings | 8,756 | 5.2 |
| Other uses | 28,787 | 17.1 |
| Resins and plastics | 4,299 | 2.6 |
| Photography and films | 1,455 | 0.8 |
| Hydraulic brake linings | 1,482 | 0.9 |
| Miscellaneous[3] | 21,072 | 12.5 |

[1]End-use data not available. [2]Includes amount for butyl cellosolve and butyl amines. [3]Includes amount used for cellulose acetate sheets, insect repellants, medicinals, flotation reagents, butyric acid, cleaners and dehydrating agents, and research.

### Benzene

| Use | 1,000 gal. | Percent |
|---|---|---|
| Total allocations | 253,132 | 100.0 |
| Direct military[1] | 1,826 | 0.7 |
| Foreign | 65 | —[2] |
| Other uses | 251,241 | 99.3 |
| Aviation gasoline[3] | 129,923 | 51.3 |
| Styrene | 49,731 | 19.6 |
| Phenol | 25,489 | 10.1 |
| Aniline | 12,834 | 5.1 |
| Chlorobenzene | 5,421 | 2.1 |
| Solvents | 5,678 | 2.3 |
| Diphenyls | 2,593 | 1.0 |
| Medicinals | 1,492 | 0.6 |
| Solvent blends[4] | 733 | 0.3 |
| Nitrobenzene | 1,217 | 0.5 |
| Rubber chemicals | 590 | 0.2 |
| Trichlorobenzene | 172 | 0.1 |
| Miscellaneous[5] | 15,368 | 6.1 |

[1]End-use data not available. [2]Less than one-tenth of one percent. [3]Includes military aviation fuel. [4]As defined and controlled by Order M-150. [5]Includes that used in nylon, phthalate plasticizers, maleic anhydride, camphor, anthraquinone, resorcinol, alcohol denaturant, small orders and other miscellaneous. Quantities used in nylon comprise a substantial part of this total. None was allocated for automotive fuel during this period.

### Phthalic Anhydride

| Use | 1,000 lb. | Percent |
|---|---|---|
| Total consumption | 124,473 | 100.0 |
| Exports | 2,324 | 1.9 |
| Other uses | 122,149 | 98.1 |
| Esters (plasticizers)[1] | 68,793 | 55.3 |
| Resins, principally alkyd | 38,113 | 30.6 |
| Dyestuffs | 10,917 | 8.8 |
| Food and drugs | 3,114 | 2.5 |
| Petroleum additives mainly demulsifying agents | 565 | 0.4 |
| Chemical intermediates | 358 | 0.3 |
| Rubber chemicals | 144 | 0.1 |
| Miscellaneous[2] | 145 | 0.1 |

[1]Largely in form of dibutyl phthalate, but includes some methyl, ethyl and amyl esters. [2]Includes use in paints, lacquers, enamels and resin softeners.


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JENNINGS, LA.
310 Thompson Bldg. TULSA, OKLA.
730 St. Charles Street NEW ORLEANS, LA.

## U. S. Production of Certain Chemicals

March 1946, March 1945 and Three Months Totals for 1946 and 1945

| Chemical and Basis | Units | March 1946 | March 1945 | Total, Three Months 1946 | Total, Three Months 1945 |
|---|---|---|---|---|---|
| Ammonia, synthetic anhydrous[2] | Tons | 44,271 | 49,089 | 125,393 | 143,708 |
| Ammonium nitrate (100% $NH_4NO_3$) | Tons | 42,860 | ..... | 119,098 | ..... |
| Ammonium sulphate, synthetic (technical) | M lb. | 18,363 | ..... | 54,214 | ..... |
| Calcium arsenate (100% $Ca_3(AsO_4)_2$) | M lb. | 1,478 | 3,200 | 3,569 | 6,004 |
| Calcium carbide (commercial) | Tons | 44,460 | 62,783 | 129,968 | 181,241 |
| Calcium phosphate: | | | | | |
| Monobasic (100% $CaH_4(PO_4)_2$) | M lb. | 6,610 | 6,032 | 18,511 | 16,060 |
| Dibasic (100% $CaHPO_4$) | M lb. | 7,233 | 3,807 | 23,068 | 10,900 |
| Carbon dioxide: | | | | | |
| Liquid and gas | M lb. | 17,681 | 19,622 | 51,078 | 52,470 |
| Solid (dry ice) | M lb. | 47,654 | 51,977 | 124,504 | 135,269 |
| Chlorine | Tons | 96,439 | 107,466 | 270,987 | 303,485 |
| Chrome green (C.P.) | M lb. | 1,981 | 325 | 5,532 | 1,717 |
| Chrome yellow and orange (C.P.) | M lb. | 4,739 | 3,610 | 13,496 | 9,944 |
| Hydrochloric acid (100% HCl) | Tons | 26,805 | 37,639 | 80,464 | 106,465 |
| Hydrofluoric acid | M lb. | 3,131 | ..... | 8,590 | ..... |
| Hydrogen | Million cu. ft. | 1,473 | 2,063 | 4,306 | 6,078 |
| Lead arsenate (acid and basic) | M lb. | 7,901 | 8,143 | 21,889 | 24,404 |
| Molybdate chrome orange (C.P.) | M lb. | 485 | 129 | 1,346 | 366 |
| Nitric acid (100% $HNO_3$) | Tons | 30,887 | 37,963 | 96,779 | 118,906 |
| Oxygen | M cu. ft. | 951,418 | 1,476,364 | 2,373,338 | 4,216,095 |
| Phosphoric acid (50% $H_3PO_4$) | Tons | 74,774 | 53,290 | 212,954 | 135,882 |
| Soda ash (commercial sodium carbonate): | | | | | |
| Ammonia soda process (98–100% $Na_2CO_3$) | | | | | |
| Total wet and dry[3] | Tons | 380,480 | 380,371 | 1,110,126 | 1,078,041 |
| Finished light[3] | Tons | 183,038 | 218,540 | 548,743 | 575,985 |
| Finished dense | Tons | 140,500 | 103,639 | 393,885 | 336,382 |
| Natural[4] | Tons | 16,175 | 15,156 | 50,368 | 43,103 |
| Sodium bicarbonate (refined) (100% $NaHCO_3$) | Tons | 18,360 | 15,570 | 57,301 | 39,736 |
| Sodium bichromate and chromate | Tons | 7,777 | 7,466 | 22,646 | 20,457 |
| Sodium hydroxide (100% NaOH): | | | | | |
| Electrolytic process: | | | | | |
| Liquid[5] | Tons | 93,335 | 101,333 | 300,859 | 287,288 |
| Solid | Tons | 15,427 | 19,304 | 47,897 | 56,885 |
| Lime soda process: | | | | | |
| Liquid[5] | Tons | 66,674 | 66,111 | 196,747 | 187,510 |
| Solid | Tons | 19,365 | 19,976 | 68,844 | 59,233 |
| Sodium phosphate: | | | | | |
| Monobasic (100% $NaH_2PO_4$) | Tons | 985 | 1,255 | 3,345 | 3,230 |
| Dibasic (100% $Na_2HPO_4$) | Tons | 5,974 | 4,554 | 16,963 | 13,185 |
| Tribasic (100% $Na_3PO_4$) | Tons | 9,165 | 6,015 | 27,810 | 19,346 |
| Meta (100% $NaPO_3$) | Tons | 2,416 | 2,297 | 7,335 | 5,984 |
| Tetra (100% $Na_4P_2O_7$) | Tons | 4,632 | 2,827 | 14,100 | 8,747 |
| Sodium silicate (anhydrous) | Tons | 32,182 | 37,105 | 99,210 | 109,077 |
| Sodium sulphate: | | | | | |
| Anhydrous (refined) (100% $Na_2SO_4$)[3] | Tons | 27,633 | 8,163 | 68,775 | 20,831 |
| Glaubers salt and crude salt cake[6] | Tons | 43,820 | 66,929 | 127,363 | 189,926 |
| Sulphuric acid (100% $H_2SO_4$)[7] | | | | | |
| Chamber process | Tons | 262,135 | 275,135 | 736,211 | 849,711 |
| Net, contact process[8] | Tons | 448,853 | 495,518 | 1,271,290 | 1,422,501 |

Data for this tabulation have been taken from "Facts for Industry" series issued by Bureau of the Census and WPB Chemicals Bureau. Production figures represent primary production and do not include purchased or transferred material. Quantities produced by government-owned arsenals, ordnance works, and certain plants operated for the government by private industry are not included. Chemicals manufactured by TVA, however, are included. All tons are 2,000 lb. Where no figures are given, data are either confidential or not yet available. [1] Includes a small amount of aqua ammonia. [2] Total wet and dry production, including quantities diverted for manufacture of caustic soda and sodium bicarbonate, and quantities processed to finished light and finished dense. [3] Not including quantities converted to finished dense. [4] Data collected in cooperation with the Bureau of Mines. [5] Figures represent total production of liquid material, including quantities evaporated to solid caustic and reported as such. [6] Includes oleum grades. Excludes spent acid. [7] Data for sulphuric acid manufactured as a byproduct of smelting operations are no longer included. This production by eight plants accounted for approximately four percent of the 1945 total production. [8] Method of reporting revised.

## United States Production of Certain Synthetic Organic Chemicals

February 1946, February 1945, and Two-Month Totals for 1946 and 1945

| Chemical | February 1946 | February 1945 | Total, Two Months 1946 | Total, Two Months 1945 |
|---|---|---|---|---|
| Acetanilid, technical and U.S.P. | 488,658 | 490,965 | 1,171,913 | ..... |
| Acetic acid: | | | | |
| Synthetic[1] | 21,344,997 | 21,914,210 | 40,888,526 | 48,228,834 |
| Recovered | 85,976,699 | ..... | 148,617,212 | ..... |
| Natural[2, 3] | 1,798,494 | 2,793,514 | 3,696,027 | 6,005,055 |
| Acetic anhydride[3] | 38,330,052 | 41,723,242 | 84,063,477 | 86,556,537 |

(*Continued on page* 308)

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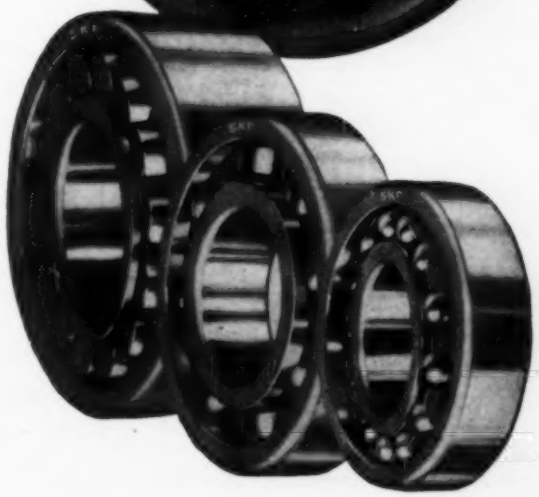
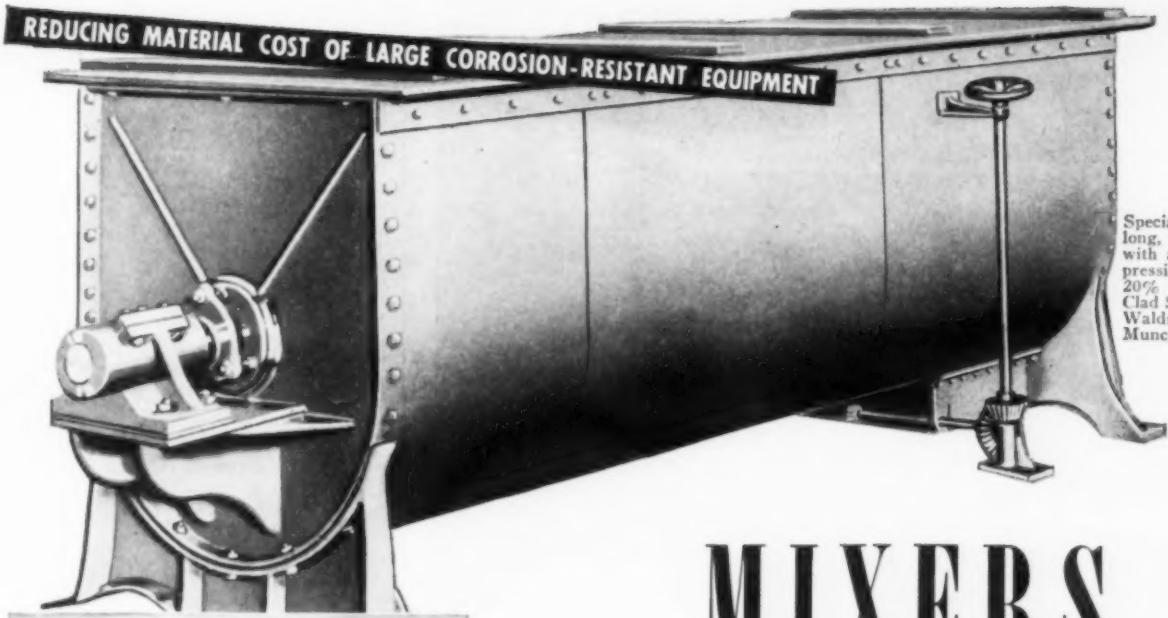


## U.S. Production of Synthetic Organic Chemicals (Cont. from page. 306)

| Chemical | February 1946 | February 1945 | Total, Two Months 1946 | Total, Two Months 1945 |
|---|---|---|---|---|
| Acetone | 26,833,544 | ..... | 52,679,975 | ..... |
| Acetylsalicylic acid | 933,846 | 816,202 | 1,920,214 | 1,702,704 |
| Aniline | 6,411,349 | ..... | 13,482,044 | ..... |
| Barbituric acid derivatives:[4] | | | | |
| 5-Ethyl-5-phenylbarbituric acid and salts (Phenobarbital) | 26,119 | 19,806 | 55,167 | 40,115 |
| Benzene: | | | | |
| Motor grade: | | | | |
| Tar distillers[5] | 953,062 | ..... | 2,017,681 | ..... |
| Coke-oven operators[6] | 1,470,881 | ..... | 4,107,329 | ..... |
| All other grades: | | | | |
| Tar distillers[5] | 1,966,576 | ..... | 3,492,090 | ..... |
| Coke-oven operators[6] | 4,342,660 | ..... | 11,107,801 | ..... |
| Butyl alcohol, primary, normal | 7,709,980 | ..... | 17,298,975 | ..... |
| Carbon bisulphide | 23,278,743 | ..... | 49,483,941 | ..... |
| Carbon tetrachloride | 13,368,298 | ..... | 25,010,961 | ..... |
| Chlorobenzene, mono | 19,882,088 | ..... | 41,868,579 | ..... |
| Creosote oil: | | | | |
| Tar distillers | 7,643,982 | ..... | 17,489,201 | ..... |
| Coke-oven operators | 798,641 | ..... | 2,714,499 | ..... |
| Cresols:[7] | | | | |
| Meta-para | 299,492 | 492,204 | 573,151 | 1,158,392 |
| Ortho-meta-para | 757,243 | 797,924 | 1,308,924 | 1,532,958 |
| Cresylic acid, refined[7] | 1,516,830 | 2,734,618 | 3,051,361 | 5,410,240 |
| Dibutyl phthalate | 1,452,979 | ..... | ..... | ..... |
| Dichlorodiphenyltrichlorethane (DDT) | 3,221,865 | ..... | 6,711,463 | 18,172,534 |
| Ethyl acetate (85%) | 6,411,541 | 9,145,083 | 12,532,143 | 14,730,497 |
| Ethyl ether, technical and U.S.P. | 2,571,081 | 7,109,254 | 5,884,078 | ..... |
| Formaldehyde (37% by wt.) | 38,253,695 | ..... | 77,464,600 | ..... |
| Methanol: | | | | |
| Natural[9] | 1,228,466 | 1,480,720 | 2,630,947 | 3,167,280 |
| Synthetic | 41,557,771 | 38,691,280 | 89,611,937 | 81,552,490 |
| Naphthalene: | | | | |
| Tar distillers (less than 79° C.)[5] | 10,074,249 | 15,825,833 | 26,059,916 | 31,213,188 |
| Tar distillers (79° and over)[5] | 6,124,861 | 5,355,560 | 16,444,835 | 10,736,533 |
| Coke-oven operators (less than 79° C.)[6] | 2,221,779 | 6,886,125 | 6,399,032 | 14,344,991 |
| Penicillin[8] | 1,702,983 | ..... | 3,215,988 | ..... |
| Phenol (synthetic and natural)[7] | 13,700,308 | ..... | 29,515,429 | ..... |
| Phthalic anhydride | 6,682,486 | 9,605,955 | 15,385,537 | 19,925,457 |
| Styrene (government owned plants only) | 25,867,056 | ..... | 52,927,884 | ..... |
| Toluene: | | | | |
| Coke-oven operators[6] | 915,245 | ..... | 2,210,422 | ..... |
| All other[6,10] | 837,926 | ..... | 1,969,118 | ..... |

All data in pounds except benzene (gal.), creosote oil (gal.), toluene (gal.), and penicillin (million Oxford units). Statistics collected and compiled by U. S. Tariff Commission except where noted. Absence of data on production indicates either that returns were unavailable or confidential. [1] Excludes the statistics on recovered acid. [2] Acid produced by direct process from wood and from calcium acetate. [3] All acetic anhydride including that from acetic acid by vapor-phase process. [4] Product of distillers who use purchased coal tar only. [5] Statistics are given in terms of bulk medicinals only. [6] Statistics collected by Bureau of Mines. [7] Total production including data reported both by coke-oven operators and by distillers of purchased coal tar. [8] Reported to U. S. Bureau of the Census. [9] Reported in gal. by Bureau of the Census but converted to lb. for comparison with the production of synthetic methanol. [10] Includes toluene produced from petroleum by any process.

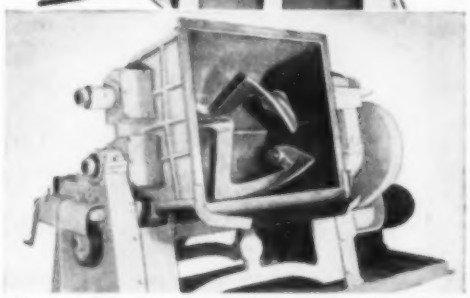
REDUCING MATERIAL COST OF LARGE CORROSION-RESISTANT EQUIPMENT



Special mixer, 8' 0" long, for mixing cork with a binder before pressing, fabricated of 20% Lukens Nickel-Clad Steel by Sprout, Waldron & Co., Inc., Muncy, Pa.

# MIXERS

## that saved $30,000 in four years



Mixer used in the preparation of a sizing clay solution for the loading of magazine paper stock. It was fabricated of 20% Lukens Nickel-Clad Steel by the J. H. Day Co., Cincinnati, Ohio.

Mixing tank, 5' 4" in diameter, used in the preparation of vitamin products, fabricated of 10% Lukens Monel-Clad Steel by Groen Manufacturing Co., Inc., Chicago, Ill.

10% Lukens Inconel-Clad Steel jacketed mixing kettle, 4' 0" in diameter, being fabricated by Alloy Fabricators Division, Newark, N. J., for a manufacturer of cosmetics.

THREE Lukens Nickel-Clad Steel mixers, of the type illustrated above, saved about $30,000 in four years for a cork manufacturer by keeping the moist cork free from black stains resulting from contact with iron.

Mixers of other types, also fabricated of Lukens Clad Steels, assure product purity by preventing harmful metallic contamination, in the handling of other materials, such as textile wetting agents, rubber, oleomargarine, fatty acids and food products; pharmaceuticals, plastics and paints; chemicals, glue, gelatin, paper and cosmetics.

Lukens Clad Steels — Nickel-Clad, Inconel-Clad and Monel-Clad — consist of a light layer of the corrosion-resistant metal, bonded permanently and homogeneously to a heavier backing plate of steel. They make available the corrosion-resistant properties of nickel, Inconel and Monel, at savings in material cost up to 60% over the cost of these metals in solid form. The availability of wide plates of Lukens Clad Steels up to 162" wide, simplifies fabrication and eliminates excessive welding, with accompanying savings. Send for Bulletin 255, "Lukens Clad Steels."

LUKENS STEEL COMPANY • 317 LUKENS BUILDING • COATESVILLE, PA.

## CHEM. & MET.

## Weighted Index of Prices for

## CHEMICALS

Base = 100 for 1937

| | |
|---|---|
| **This month** | **109.13** |
| Last month | 109.13 |
| June, 1945 | 108.93 |
| June, 1944 | 109.59 |

## CURRENT PRICES

The accompanying prices refer to round lots. Where it is trade custom to sell f.o.b. works, quotations are so designated. Prices are corrected to June 11.

### INDUSTRIAL CHEMICALS

| | | |
|---|---|---|
| Acetone, tanks, lb | $0.06 | – |
| Acid, acetic, 28%, bbl., 100 lb | 3.38 | – $3.63 |
| Boric, bbl., ton | 109.00 | –113.00 |
| Citric, kegs, lb | .20 | – .23 |
| Formic, cbys, lb | .10½ | – .11 |
| Hydrofluoric, 30%, drums, lb | .08 | – .085 |
| Lactic, 44% tech., light, bbl., lb | .073 | – .075 |
| Muriatic, 18°, tanks, 100 lb | 1.05 | – |
| Nitric, 36°, carboys, lb | .05 | – .05½ |
| Oleum, tanks, wks., ton | 18.50 | – 20.00 |
| Oxalic, crystals, bbl., lb | .11½ | – .12½ |
| Phosphoric tech., tanks, lb | .04 | – |
| Sulphuric, 60°, tanks, ton | 13.00 | – |
| Tartaric, powd., bbl., lb | .62 | – .65 |
| Alcohol, amyl from pentane, tanks, lb | .131 | – |
| Alcohol, butyl, tanks, lb | .10½ | – .21 |
| Alcohol, ethyl, denatured, No. 1 special, tanks, gal | .542 | – |
| Alum, ammonia, lump, lb | .04½ | – |
| Aluminum sulphate, com. bags 100 lb | 1.15 | – 1.45 |
| Ammonia, anhydrous, cyl., lb | .14½ | – |
| tanks, ton | 59.00 | – 61.50 |
| Ammonium carbonate, powd., casks, lb | .09½ | – .10 |
| Sulphate, wks., ton | 28.20 | – |
| Amyl acetate, tech. from pentane, tanks, lb | 1.45 | – |
| Aqua ammonia, 26°, drums, lb | .02½ | – .03 |
| tanks, ton | 65.00 | – |
| Arsenic, white, powd., bbl., lb | .04 | – .04½ |
| Barium carbonate, bbl., ton | 65.00 | – 75.00 |
| Chloride, bbl., ton | 75.00 | – 78.00 |
| Nitrate, casks, lb | .09½ | – .11 |
| Blanc fix, dry, bags, ton | 60.00 | – 70.00 |
| Bleaching powder, f.o.b., wks., drums, 100 lb | 2.50 | – 3.00 |
| Borax, gran., bags, 100 lb | 4.50.00 | – |
| Calcium acetate, bags, 100 lb | 3.00 | – |
| Arsenate, dr., lb | .07½ | – .08 |
| Carbide, drums, ton | 50.00 | – |
| Chloride, flake, bags, del., ton | 18.50 | – 25.00 |
| Carbon bisulphide, drums, lb | .05 | – .07 |
| Tetrachloride, drums, gal | .73 | – .80 |
| Chlorine, liquid, tanks, wks., 100 lb | 1.75 | – 2.00 |
| Copperas, bgs., f.o.b., wks., ton | 17.00 | – 18.00 |
| Copper carbonate, bbl., lb | .19½ | – .20 |
| Sulphate, bbl., 100 lb | 5.00 | – 5.50 |
| Cream of tartar, bbl., lb | .50 | – .52 |
| Diethylene glycol, dr., lb | .14½ | – .15 |
| Epsom salt, dom., tech., bbl., 100 lb | 1.80 | – 2.00 |
| Ethyl acetate, tanks, lb | .09½ | – .11 |
| Formaldehyde, 40%, tanks, lb. wks. | .032 | – |
| Furfural, tanks, lb | .09½ | – |
| Glaubers salt, bags, 100 lb | 1.05 | – 1.10 |
| Glycerine, c.p., drums, extra, lb | .18½ | – .19 |
| Lead: | | |
| White, basic carbonate, dry, casks, lb | .08½ | – |
| Red, dry, sck., lb | .09½ | – |
| Lead acetate, white crys., bbl., lb | .12½ | – .13 |
| Arsenate, powd, bag., lb | .11½ | – .12 |
| Lithopone, bags, lb | .04½ | – .04½ |
| Magnesium carb., tech., bags, lb | .07½ | – .08 |
| Methanol, 95%, tanks, gal | .60 | – |
| Synthetic, tanks, gal | .24 | – |
| Phosphorus, yellow, cases, lb | .23 | – .25 |
| Potassium bichromate, casks, lb | .10½ | – .10½ |
| Chlorate, pwd., lb | .09½ | – .12 |
| Hydroxide (c'stic potash) dr., lb | .07 | – .07½ |
| Muriate, 60%, bags, unit | .53½ | – |
| Nitrate, ref., bbl., lb | .08 | – .09 |
| Permanganate, drums, lb | .19½ | – .20 |
| Prussiate, yellow, casks, lb | .16 | – .17 |
| Sal ammoniac, white, casks, lb | .0515 | – .06 |
| Salsoda, bbl., 100 lb | 1.00 | – 1.05 |
| Salt cake, bulk, ton | 15.00 | – |
| Soda ash, light, 58%, bags, contract, 100 lb | 1.05 | – |
| Dense, bags, 100 lb | 1.15 | – |
| Soda, caustic, 76% solid, drums, 100 lb | 2.30 | – 3.00 |
| Acetate, del., bbl., lb | .05½ | – .06 |
| Bicarbonate, bbl., 100 lb | 1.70 | – 2.00 |
| Bichromate, bags, lb | .07½ | – .08 |
| Bisulphate, bulk, ton | 16.00 | – 17.00 |
| Bisulphite, bbl., lb | .03 | – .04 |

## CHEM. & MET.

## Weighted Index of Prices for

## OILS & FATS

Base = 100 or 1937

| | |
|---|---|
| **This month** | 145.80 |
| Last month | 145.80 |
| June, 1945 | 145.85 |
| June, 1944 | 145.24 |

| | | |
|---|---|---|
| Chlorate, kegs, lb | $0.06½ – | $0.06¾ |
| Cyanide, cases, dom., lb | .14½ – | .15 |
| Fluoride, bbl., lb | .07 – | .08 |
| Hyposulphite, bags, 100 lb | 2.25 – | 2.50 |
| Metasilicate, bbl., 100 lb | 2.50 – | 2.65 |
| Nitrate, bulk, ton | 27.00 | |
| Nitrite, casks, lb | .06½ – | .07 |
| Phosphate, tribasic, bags, 100 lb | 2.70 | |
| Prussiate, yel., bags, lb | .10½ – | .11 |
| Silicate, 40°, dr., wks., 100 lb | .80 – | .85 |
| Sulphite, crys., bbl., lb | .02½ – | .02¾ |
| Sulphur, crude at mine, long ton | 16.00 | |
| Dioxide, cyl., lb | .07 – | .08 |
| Dioxide, tanks, lb | .04 | |
| Tin crystals, bbl., lb | .39½ | |
| Zinc chloride, gran., bbl., lb | .05½ – | .06 |
| Oxide, lead free, bags, lb | .07½ | |
| Oxide, 5% leaded, bags, lb | .07½ | |
| Sulphate, bbl., cwt | 3.85 – | 4.00 |
| **OILS AND FATS** | | |
| Castor oil, No. 3 bbl., lb | $0.14½ | $0.15¼ |
| Chinawood oil, tanks, lb | .38½ | |
| Coconut oil, Ceylon, N. Y., lb | .08¾ | |
| Corn oil crude, tanks (f.o.b. mill), lb | .12¼ | |
| Cottonseed oil crude (f.o.b. mill), tanks, lb | .12½ | .12¾ |
| Linseed oil raw, car lots, bbl., lb | .15½ | |
| Palm, casks, lb | .08¾ | |
| Peanut oil, crude, tanks (mill), lb | .12½ | |
| Rapeseed oil, refined, bbl., lb | nom. | |
| Soybean, tanks, lb | .11¼ | |
| Menhaden, light, pressed, dr., lb | .13 | |
| Crude, tanks (f.o.b. factory) lb | .09 | |
| Grease, yellow, loose, lb | .08½ | |
| Oleo stearine, lb | .09½ | |
| Oleo oil, No. 1, lb | .11¼ | |
| Red oil, distilled, bbl., lb | .13 | |
| Tallow extra, loose, lb | .08½ | |
| **COAL-TAR PRODUCTS** | | |
| Alpha-naphthol, crude, bbl., lb | $0.52 – | $0.55 |
| Alpha-naphthylamine, bbl., lb | .32 – | .34 |
| Aniline oil, drums, extra, lb | .11½ – | .12½ |
| Aniline salts, bbl., lb | .22 – | .24 |
| Benzaldehyde, tech., dr., lb | .45 – | .50 |
| Benzidine base, bbl., lb | .70 – | .75 |
| Benzoic acid, USP, kegs, lb | .54 – | .56 |
| Benzol, 90%, tanks, works, gal | .15 | |
| Benzyl chloride, tech., dr., lb | .22 – | .24 |
| Beta-naphthol, tech., drums, lb | .23 – | .24 |
| Cresol, USP, dr., lb | .10¼ | |
| Cresylic acid, dr., wks., gal | .81 – | .83 |
| Diphenyl, bbl., lb | .15 – | |
| Diethylaniline, dr., lb | .40 – | .45 |
| Dinitrotoluol, bbl., lb | .18 – | .19 |
| Dinitrophenyl, bbl., lb | .22 – | .23 |
| Dip oil, 15%, dr., gal | .23 – | .25 |
| Diphenylamine, dr., f.o.b. wks., lb | .25 | |
| H acid, bbl., lb | .45 – | .50 |
| Hydroquinone, bbl., lb | .90 | |
| Naphthalene, flake, bbl., lb | .07 – | .07½ |
| Nitrobenzene, dr., lb | .08 – | .09 |
| Para-cresol, bbl., lb | .41 | |
| Para-nitroaniline, bbl., lb | .42 – | .43 |
| Phenol, USP, drums, lb | .10 – | .11 |
| Picric acid, bbl., lb | .35 – | .40 |
| Pyridine, dr., gal | 1.55 – | 1.60 |
| Resorcinol, tech., kegs, lb | .65 – | .70 |
| Salicylic acid, tech., bbl., lb | .26 – | .33 |
| Solvent naphtha, w.w., tanks, gal | .26 | |
| Toluidin, bbl., lb | .96 | |
| Toluol, drums, works, gal | .32 | |
| Xylol, com., tanks, gal | .25 | |
| **MISCELLANEOUS** | | |
| Casein, tech., bbl., lb | $0.33 – | $0.35 |
| Dry colors: | | |
| Carbon gas, black (wks.), lb | .0365 – | .097 |
| Prussian blue, bbl., lb | .36 – | .37 |
| Ultramarine blue, bbl., lb | .11 – | .26 |
| Chrome green, bbl., lb | .23 – | .33 |
| Carmine red, tins, lb | 4.60 – | 4.75 |
| Para toner, lb | .75 – | .80 |
| Vermilion, English, bbl., lb | 2.50 – | 2.65 |
| Chrome yellow, C.P., bbl., lb | .16 – | .17 |
| Gum copal, Congo, bags, lb | .09 – | .55 |
| Manila, bags, lb | .09 – | .15 |
| Damar, Batavia, cases, lb | .10 – | .22 |
| Kauri, cases, lb | .18 – | .60 |
| Magnesite, calc., ton | 64.00 | |
| Pumice stone, lump, bbl., lb | .05 – | .07 |
| Rosin, H., 100 lb | 7.43 – | |
| Shellac, orange, fine, bags, lb | .46 | |
| Bleached, benedry, bags, lb | .42½ | |
| T. N., bags, lb | .35½ | |
| Turpentine, gal | .93½ – | .94¼ |

# NEW CONSTRUCTION

| | Current Projects | | Cumulative 1946 | |
|---|---|---|---|---|
| | Proposed Work | Contracts | Proposed Work | Contracts |
| New England | $175,000 | $1,191,000 | $715,000 | $3,784,000 |
| Middle Atlantic | 1,975,000 | ..... | 3,111,000 | 6,644,000 |
| South | 22,900,000 | ..... | 50,560,000 | 34,487,000 |
| Middle West | 150,000 | 115,000 | 11,368,000 | 37,815,000 |
| West of Mississippi | 7,225,000 | 3,547,000 | 78,180,000 | 36,023,000 |
| Far West | 100,000 | 1,000,000 | 2,355,000 | 9,207,000 |
| Canada | ..... | 380,000 | 405,000 | 15,243,000 |
| Total | $32,525,000 | $6,233,000 | $146,694,000 | $143,203,000 |

## PROPOSED WORK

Ala., Childersburg—Coosa River Newsprint Co., c/o J. W. Brown, First Natl. Bank Bldg., Sylacauga, Ala., contemplates the construction of a newsprint manufacturing plant here. J. E. Sirrine & Co., Greenville, S. C., Milton Fies, Birmingham, Ala., and Polk, Powell & Henderson, Birmingham, Ala., Cons. Engrs. Estimated cost $10,000,000.

Fla., Jacksonville—Union Bag & Paper Co., Lathrop Ave., Savannah, Ga., will not construct paper mill here on Trout River. Estimated cost $2,500,000.

Md., Baltimore—C. M. Athey Paint Co., 500 South Hanover St., plans to construct a paint manufacturing plant. Henry P. Hopkins, 10 East Mulberry St., Archt. Estimated cost $125,000.

Miss., Jackson—Armstrong Cork Co., Liberty and Mary Sts., Lancaster, Pa., plans to construct an asphalt tile plant here. H. A. Kulpan & Co., 1518 Walnut St., Philadelphia, Archt. Estimated cost will exceed $100,000.

Miss., Natchez—Gulf Refining Co. and California Co., Jackson, plan to construct a cycling plant in this area. Estimated cost $6,500,000.

N. J., Burlington—Hercules Powder Co., 900 Market St., Wilmington, Del., plans to construct a chemical plant here. Estimated cost $1,500,000.

N. C., Acme—Riegel Paper Corp., 345 Madison Ave., New York City, and Bolton, N. C., plans to construct a paper plant on the Cape Fear River. Estimated cost $6,300,000.

O., Cincinnati—Procter & Gamble Co., Spring Grove Ave., Ivorydale, Cincinnati, O., plans to construct an alcohol plant here. Day & Zimmerman, Inc., Packard Bldg., Philadelphia, Pa., Archts. Estimated cost $150,000.

Ore., Portland—Western Waxed Paper Co., Public Service Bldg., plans to construct a 1 story addition to its plant. Whitehouse, Church, Newberry & Roehr, Builders Exchange Bldg., Archts. Estimated cost $100,000.

Pa., Johnsonburg—Castanea Paper Co., Johnsonburg, plans to construct a 2 story laboratory addition. Estimated cost $150,000.

Pa., Neville Island—Neville Island Glass Co., Olean, N. Y., plans to construct a 1 story plant here. Estimated cost $150,000.

Pa., Philadelphia—Penn City National Oil Co., 82nd St. and Bartram Ave., plans to construct a processing and storage building. Estimated cost $50,000.

R. I., Providence—Queen Dyeing Co., 589 Atwells Ave., plans to rebuild its factory. Lockwood-Greene Engineers, Inc., 40 Central St., Boston, Mass., Eng. Estimated cost $175,000.

Tex., Carthage—Rogers Lacy & Associates, Longview, plan to construct a recycling plant in this area. Estimated cost $4,500,000.

Tex., Dallas—Eastman Kodak Co., 1504 Young St., plans to construct plant here including color processing plant unit. Estimated cost $225,000.

Tex., Lamesa—Texas Co., Magnolia Petroleum Co., Honolulu Corp. and Stanolind Oil & Gas Co., Fair Bldg., Fort Worth, plan to construct a natural gasoline manufacturing plant in Slaughter Field. Estimated cost $2,000,000.

Tex., LaPorte—E. I. du Pont de Nemours & Co., LaPorte, plans to construct additional chemical plant facilities. Estimated cost $500,000.

## CONTRACTS AWARDED

Ark., El Dorado—Lion Oil Co., El Dorado, has awarded the contract for a catalytic cracking unit to Lummus Co., Esperson Bldg., Houston, Tex. Estimated cost $1,250,000.

Ark., North Little Rock—Buckeye Cotton Oil Co., North Little Rock, has awarded the contract for a warehouse to Grady & Garms, Little Rock, at $41,500.

Calif., Pasadena—Allied Products, Inc., Suffern, N. Y., has awarded the contract for a cosmetic factory here to Wm. Simpson Construction Co., 816 West 5th St., Los Angeles. Estimated cost $500,000.

Calif., Richmond—Standard Oil Co. of California, (California Research Corp.), 225 Bush St., San Francisco, has awarded the contract for a laboratory and industrial relations building and office, to M. & F. Corp., 200 Financial Center Bldg., San Francisco, at $696,000.

Calif., San Francisco—American Marine Paint Co., 311 California St., has awarded the contract for the construction of a warehouse to Dinwiddie Construction Co., 211 Crocker Bldg. Estimated cost $50,000.

Conn., Waterbury—Waterbury Ready Mixed Paint Co., 94 Benedict St., will construct a storage plant. Work will be done by owner. Estimated cost $40,000.

Ia., Dubuque—Virginia-Carolina Chemical Corp., Dubuque, has awarded the contract for a fertilizer plant to Ulrich Willys, Dubuque. Estimated cost $145,000.

Mass., Everett—Monsanto Chemical Co., Chemical Lane, Everett, has awarded the contract for the construction of a laboratory to William M. Bailey Co., 88 Broad St., Boston. Estimated cost $234,000.

Mo., Sedalia—Pittsburgh Corning Corp., 632 Duquesne Way, Pittsburgh, Pa., has awarded the contract for design and construction of two plants here for the production of glass block and Foamglas, a cellular glass insulating material, to H. K. Ferguson Co., Hanna Bldg., Cleveland, O. Estimated cost $2,000,000.

N. H., Berlin—Brown Co., 650 Main St., has awarded the contract for the construction of a factory including sulphate mill and dryer plant to Rust Engineering Co., Clark Bldg., Pittsburgh, Pa., at $917,491.

O., Cleveland—Compressed Gasses, Inc., 3620 Superior Ave., has awarded the contract for a factory and office building to Hadlock-Krill Co., 2169 East 33rd St., at $60,000.

O., Toledo—Libbey Glass Div. of Owens-Illinois Glass Co., Ash St., has awarded the contract for a second story room within existing building to Myron Miller, Elm St. Estimated cost $55,000.

Ore., Portland—Pennsylvania Salt Manufacturing Co., 6400 N. W. Front Ave., has awarded the contract for two masonry and steel buildings to house electro-chemical manufacturing facilities to Roy T. Earley & Co., 321 Middle Waterway, Tacoma, Wash. Estimated cost $300,000.

Tex., McQueeney—Seguin Brick & Tile Co., 702 American Hospital & Life Bldg., San Antonio, will construct a kiln unit. Work will be done by force account and subcontracts. Estimated cost $55,000.

Utah, Salt Lake City—Bennett Glass & Paint Co., 65 West First South St., has awarded the contract for a warehouse to Jacobsen Construction Co., 724 South 3rd East St. Estimated cost $150,000.

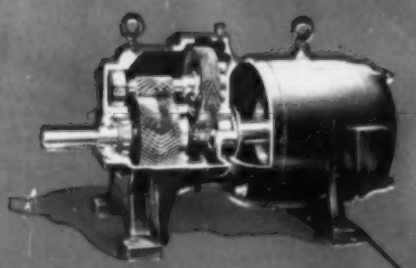
Wis., Kaukauna—Thilamany Pulp & Paper Co., Kaukauna, has awarded the contract for a 1 story, 37x200 ft. addition to its plant to Permanent Construction Co., 4100 North Third St., Milwaukee.

B. C., New Westminster—Westminster Paper Co., Ltd., 16th St. and 5th Ave., has awarded the contract for a new finishing building to Dominion Construction Co., Ltd., 150 West First Ave., Vancouver, B. C. Estimated cost $140,000.

B. C. Woodfibre—B. C. Pulp & Paper Co., Ltd., 602 West Hastings St., Vancouver, B. C., has awarded the contract for three chip storage bins to Dominion Construction Co., Ltd., 150 West First Ave., Vancouver. Estimated cost $75,000.

Ont., Toronto—Acme Paper Products, Ltd., 388 Carlaw Ave., has awarded the contract for an addition to its plant to Bardford-Hoskal, Ltd., 1170 Vonge St. Estimated cost $65,000.

Ont., Toronto—Drug Trading Co., Ltd., 6 Ontario St., has awarded the contract for an additional story to its plant to Dickie Construction Co., Ltd., 17 Yorkville Ave. Estimated cost $100,000.



# *the* RIGHT *horsepower*
# *the* RIGHT *shaft speed*
# *and* RIGHT *where you want it*

That's the horsesense way to use horsepower. See how the designer of this cement cooling equipment has secured power right where he needs it . . . and at exactly the right speed. Easy to order, easy to use, he has saved himself time, space and money by using these compact, integrally built power units. How else could he have secured such a clean cut, economical design.

And nowhere, but in the Master line of Gearmotors, could he have found power units that are so flexible, so easily adaptable and in such a wide range of sizes and types. They are available in any size, 100 HP and smaller . . . for all cycles, phases and frequencies . . . in open, splash proof, totally enclosed, fan cooled and explosion proof types . . . with Speedrangers (mechanical variable speed) and Unibrakes . . . for every type mounting.

Increase the salability of your motor driven products . . . improve the economy, safety and productivity of your plant equipment, with Master Gearmotors . . . the horsesense way to use horsepower.

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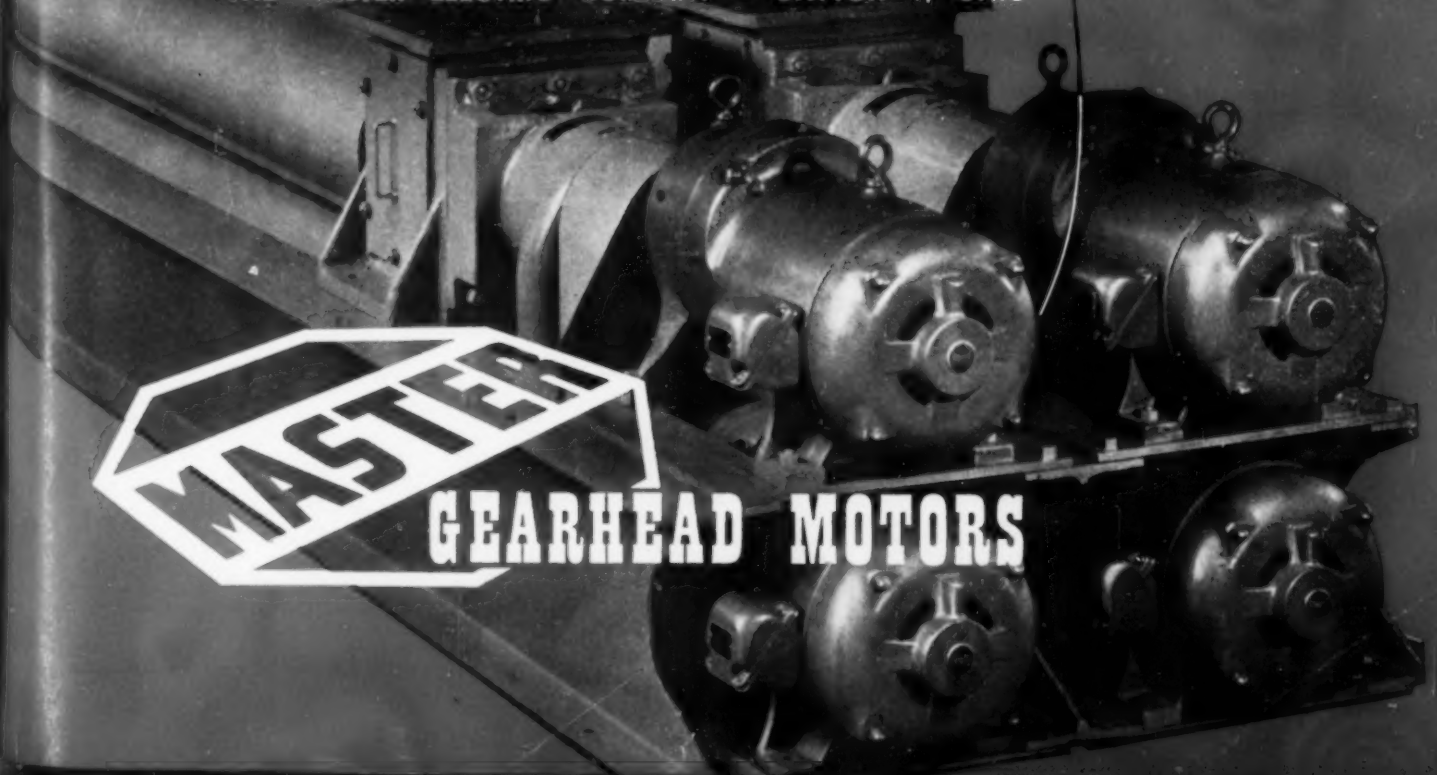
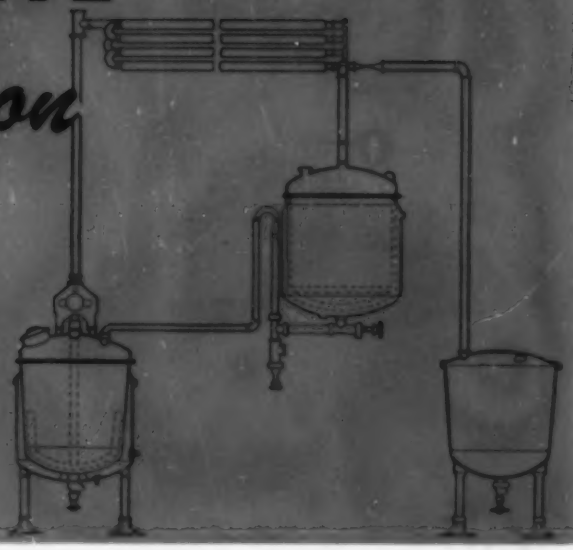


MASTER

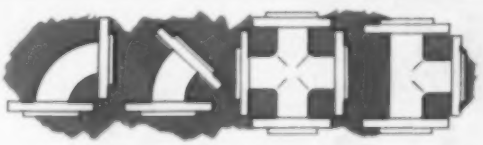
GEARHEAD MOTORS

# 100% COMPLETE
# *Process Protection*



**You can eliminate weak "links" in your process layout *by the addition of* Pfaudler glass-lined pipe, fittings and valves.**

Have you stopped corrosion with glass-lined steel equipment in one stage of processing and overlooked it in another? Others have. How about your pipe lines, fittings and valves? Besides reactors, stills, condensers and storage tanks, Pfaudler makes a complete line of glass-lined pipe, fittings and valves. Some of the highlights of these lines are indicated below . . . and we'll be glad to send more complete information on request.



**Flanged glass-lined fittings** complete the all-glass-lined assembly . . . keep corrosion under control *all the way*. Standard 125 P.S.I. fittings include straight and reducing tees, elbows, crosses, reducers, bends, etc. from 1½" to 12". Special fittings are made on request. To obtain maximum service from glass-lined process equipment, it is important to select a proper gasketing material. Gaskets for all glass-lined connections are obtainable from Pfaudler.

**Flanged glass-lined pipe** is available in diameters of 1½" and upward, lined with Pfaudler highly acid resisting glass. Maximum lengths: 1½" size, 36"; all others, 10 ft. Standard pressure, 125 lbs. Heavy duty designs are in successful operation at pressures up to 300 lbs. Jacketed and unjacketed pipe also available as heat exchangers and condensers, connected in series or parallel by 180° glass-lined return bends. The inherent flexibility of the straight pipe return bend design results in a wide selection of heat transfer surfaces.

**Pfaudler Heavy-Duty Glass-Lined Valves** (flush, safety, and line) are built for rugged service. Limited pressure, 125 P.S.I. All valve bodies are made of cast iron, glass-lined, and are equipped with porcelain valve heads and seats which are free from mechanical and thermal strains. Flush valve openings: 2" to 1½"; 3" to 2"; 4" to 3". Safety and line valves: 1½"; 2", 3".

Perhaps Pfaudler glass-lined equipment could do a *better job for you* if utilized to fullest advantage. Our engineers will be glad to recommend complete glass-lined process assemblies with which to meet your conditions most economically. We welcome your inquiries and of course will be glad to send you literature. Write The Pfaudler Co., Rochester 4, N. Y.

**Pfaudler**

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**THE PFAUDLER CO., ROCHESTER 4, NEW YORK**

ENGINEERS AND FABRICATORS OF CORROSION RESISTANT PROCESS EQUIPMENT

Glass-Lined Steel . . . Stainless Steels . . . Nickel . . . Inconel . . . Monel Metal